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Electrical World

McGraw-Hill Company, Inc.

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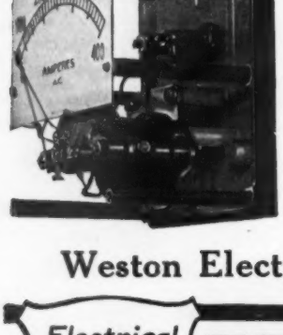

Illumination. The scale is remarkably free from shadows. Figures are bold and stand out plainly even at a distance. The pointer is visible for a great part of its length.

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WESTON

STANDARD - The World Over

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

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Where Lack of Standardization Penalizes

THE present drought on the Pacific Coast, and particularly in California, is of serious proportions, and while the public has shown a commendable spirit of co-operation in curtailing the needless use of electricity and the generating systems possessing steam stations have gone to the limit in pooling their resources, the mixture of frequencies has offered obstacles to maximum relief. While all of the large electric operating companies in the State of Washington and most of the operating companies in Oregon and California generate 60-cycle energy, there is considerable 33-cycle equipment in the vicinity of Portland and 50-cycle equipment in the vicinity of Los Angeles. From an operating as well as a service viewpoint there is nothing to choose between 50 cycles and 60 cycles. The disadvantage lies in the fact that 60 and not 50 cycles is the standard frequency in the United States, and in the present emergency it may well be imagined that the cities of Pasadena and Los Angeles and the Southern California Edison Company alike wish they too had standardized on the first-named frequency.

In all probability as a result of the present experience 50-cycle service will soon disappear in California. A like fate will befall 33-cycle service in Oregon, for it is unlikely that the lessons taught by the present drought will be lost on any of the operating companies on the Pacific Coast. Other electric public utilities might also take the lesson to heart, since the lack of a standard frequency offers not only obstacles to emergency help but also to interconnection and unified service. The sooner the change is made, the better and the less costly it will be.

The Larger Aspects of Post Office Service

SERVICE in its broadest and all-embracing sense is what the electrical industry strives to render. It recognizes its obligation to the public in this regard, and should it ever forget it—which heaven forbid!—the public service commissions are an ever-present reminder. In a striking letter Charles W. Eliot, president emeritus of Harvard University, takes the Post Office administration to task for its parsimony whenever and wherever the practice of this otherwise commendable virtue has resulted in impaired service. What the Post Office Department lacks is vision. Its notion of its functions is too low and commonplace. High aspects of service are lacking. Mail is delivered by the calendar rather than by the clock, and all business suffers. Promptness and dispatch, necessary attributes to business, are honored more in the breach than in the observance. There are obligations which a nation owes to its citizens in return for taxes. Almost every other department of the government is maintained out of taxes, and the benefit which each bestows on the individual is small. The Post Office Department, on the other hand, concerns almost every one. All the more reason why its service, which is so intimate, should be improved. Speedier delivery of mail without added cost is a national need. The army and navy can send airplanes around the world at great expense with results of doubtful advantage. We would not deprive either of this right, but why should the Post Office Department not have a huge fleet of airplanes for long-distance work, of automobiles and motorcycles for shorter distances, and enough men to handle local mail more expeditiously? If the Post Office Department had a broader conception of its functions, these things would not be lacking, nor would the financial support necessary to maintain them be withheld by Congress. It is because its service is mediocre that the Post Office Department is open to justifiable criticism and attack.

"Ionizing Potential" in Human Affairs

PHYSICISTS assert that the phenomena of sparkover and corona are due to the dynamic action of minute corpuscles, positive or negative, which split neutral molecules of gas. The detached active part of a molecule, already possessed of high velocity of rotation, now acquires a sufficient linear velocity to become in turn an active ionizer or "splitter" and wreaks similar destruction on other molecules, until the whole mass of the gas becomes a carrier of an electric current. Thus, let there be originally only one free ion, and let it run amuck and split, say, ten molecules before being arrested or before peacefully uniting with a stray ion of the opposite sex, then at the end of its riotous career there will be ten ions capable of creating havoc with neutral molecules. If each of these in turn breaks up, say, ten molecules, then there will be a hundred free ions, which later are multiplied to a thousand, ten thousand and so on. The minimum voltage at which a free ion moves fast enough to split a neutral molecule is called the ionizing potential.

Whether this theory is right or not, it suggests a helpful analogue in human affairs. A small group of persons get an idea which they try to impose upon the rest of humanity, but no one seems to be particularly interested or sympathetic. Another group of persons get a similar idea, and in a short time large numbers of people begin to believe in it and many become apostles of the new faith, splitting neutral human molecules and converting them into active charged particles, spreading the new gospel. The first group of persons did not have the ionizing potential, did not have that superior force before which inertia and opposition are helpless, while the second group did have it.

Thousands of tons of perfectly good paper are being

uselessly wasted in various campaigns, carrying slogans, appeals, intimate talks, cajolings, concealed threats, inside information, offers of premiums, congressmen's speeches, and what not. Now and then a highly charged message ion, moving under the irresistible electric force of a true inspiration, ionizes the whole world, awakens our dormant emotions and makes us wish to do great things. Elbert Hubbard's "Message to Garcia" might be called such an ion.

The moral, of course, is that men should examine their advertisements, their letters, their messages, their expressed ideas more severely before proclaiming them —test them for power; in other words, for ionizing potential—that the world may be spared the turmoil of talk, the clutter of correspondence and the avalanche of print, most of it doomed as it comes from the press, under which we stagger and struggle today.

"Ye Shall Know the Truth"— An Impression from England

ADVERTISING has come to be a common denominator to all business. Executives of the electrical industry will therefore feel more than a general interest in the impression which Americans have brought back from the recent international advertising convention held in London. In a word, this impression made manifest by qualified spokesmen, is that although tremendous advances have been made in America in the technique and detail of advertising and we have undoubtedly advanced in its applications beyond any other nation, the Englishman has perhaps come to a deeper realization of the fundamental values of advertising as a constructive influence for use along lines that transcend business limitations and exert a shaping influence, social, national and economic, on modern civilization. This was exemplified in a sermon on advertising preached in Westminster Abbey by the Bishop of Durham, who, speaking on the theme "Ye shall know the truth, and the truth shall make you free," exhorted all advertising men to keep their aims and purposes high. Members of the British government addressed the convention on advertising as an instrument for public and industrial education and called upon advertising men to use their influence through the public prints to bring about a better understanding between nations, and the convention responded with a resolution pledging the delegates from all nations to lend their power and influence to abolish war.

The keynote of many fine addresses on the economic importance of advertising was struck by Winston Churchill, when he said: "The great upward movement of productivity was checked by the war, but not arrested. . . . We are suffering from a serious and widespread decline in consuming power. . . . It spurs exertion. It brings together in fertile union what otherwise would have never met. . . . The advertisement is a protection against profiteering. The standard of the goods is made uniform. Advertising is a great security to the public against fraud. . . . Truth will conquer; beauty is a practical utility; art is serviceable in itself; merit will achieve its just reward; better times are coming to all of us and to the whole world; all the men in all lands are necessary to one another."

Advertising is a great instrument in the distribution of commodities and equipment in this complex age. But in filling this function advertising is only in its beginning, if its power is to be guided by the great ideals set forth in the convention just closed. In England today, and the thing will be increasingly true of America, men are looking to advertising as a great instrument for social influence—one that gives promise of help not alone to the business man and to industry but to each nation and to all humanity in the solving of the besetting problems of our complex modern civilization.

Importance of Local and Diversified Ownership of Utilities

TO NO small extent the stability of the electric utility industry depends on the extent to which its securities become distributed among the populations served by the operating companies. Good service and fair rates are fundamental. Given these, the incentive of participation in security ownership is of importance in safeguarding the industry from the evils, and especially from the stagnation, of organized public ownership. The record of the industry in customer ownership is marvelous, considering the few years during which this inspiring movement has been under way; but the times call clearly for more vigorous activity along these lines.

The undercurrents of socialism are still swirling about the foundations of democratic institutions; politicians try to make capital out of assaults on operating companies privately owned and publicly regulated and misrepresentation never seems to hide its ugly head. The antidotes for these are, first and most important, good service at fair rates; second, local ownership of utility securities, because of the co-operative relationship and mutual interest thereby established.

Some companies think so highly of customer ownership that they purchase large blocks of stocks in the open market from time to time and offer them to customers. Over-the-counter deliveries on the day of purchase help, as will term-payment plans and more "home town" advertising. The essential thing is to get local and diversified ownership, and the reward of such efforts will greatly exceed their cost in years to come.

Costs of Underground Construction

THE development of the underground systems of transmission and distribution in the last few years has been made along lines of increased number of refinements and consequently increased costs. While it is quite justifiable to invest large sums of money in the perfection of an underground transmission system of high voltage which handles large loads and to regard expense as second to reliability of service, there may be serious danger in not making an effort to reduce expenses that are now considered necessary to furnish underground secondary service from the distribution system. Very little has been done so far to try to minimize the costs of such service, and without pointing here to any definite means of decreasing these costs, it may be asserted confidently that present methods result in too much expense and that these methods must in some way be changed in the interests of economy.

The desire for the elimination of pole lines and service drops in a city is a justifiable one from the standpoint of appearance, and the central-station industry has always indicated its desire to co-operate in the

beautifying of streets. When by so doing the cost of furnishing service is increased to an undue extent, a serious economic loss, however, ensues. It would, therefore, be well to find out whether there are cheaper means of furnishing secondary service and possibly to change some of the accepted ideas as to what the requirements of good service are. As a suggestion it might be well to consider electrical supply to residences and stores not in terms of aërial service or underground service, but in terms of exposed service or concealed service, and to co-operate with the cities and the property owners in developing new means of providing such service.

Potential Competition as a Spur to Utility Service

THE monopolistic aspect of public utility operation, because not understood, is not always accepted by the public. Even with rates fixed by a regulatory commission, the old prejudice against monopoly still remains. One of the best methods of softening this prejudice was recently well depicted by a utility operator who declared: "If you want to make your utility company popular, you must run it as if a competitor were located next door." Thus, in a few words, he struck the keynote of the problem with which all utilities are battling in trying to improve customer relationships. However cruel the old wolf competition may be, it has some virtues in holding business together on a fairly even plane.

Were competition the guiding element of public utility operation, however, many economies now enjoyed would disappear. The idea is not to apply competition with its wasteful duplication, but to imagine it as a spur to better treatment of customers and the public. Many situations now dealt with in an aimless way would of necessity have to be corrected if potential competition were the deciding element, and without doubt a marked improvement in service and sometimes in rates would ensue. Did electric public utility companies operate on this plan, the antagonistic customers camped on the companies' doorstep would often, like the Arab, fold their tents and silently steal away.

Little New Light Thrown on Rural Electric Service

ELECTRICITY for rural communities was discussed at some length at the recent World Power Conference, but few new or constructive data were made available. For England, R. Borlase Matthews used his model farm to illustrate the use of electricity and argued that a farming community can afford to pay a comparatively high price for electricity. For Sweden, N. Ekwall stated that 40 per cent of the cultivated land was electrified, giving a load of 260,000 kw. and an annual consumption of 120,000,000 kw.-hr. This represented only 30 per cent of the possible consumption. For Denmark, V. F. Andersen reported that electricity was used extensively on farms and that experience indicated it was economical to use the best available materials in the system. H. Wallem of Germany outlined the use of portable equipment in that country and asserted that the energy used varied from 6.4 kw.-hr. to 10.4 kw.-hr. per acre, but that electric cooking, if adopted, would increase this figure very greatly.

Not much progress was recorded in the development of new methods or new equipment whereby rural loads could be made greater or rural service rendered more economically. A few lamps and intermittently used motors compose the electric equipment of the average farm. Apparently more hope for the development of rural service lies in the experimental work now going on in this country than in the accomplishments of engineers in other parts of the world.

Field Data on Lightning Are Needed

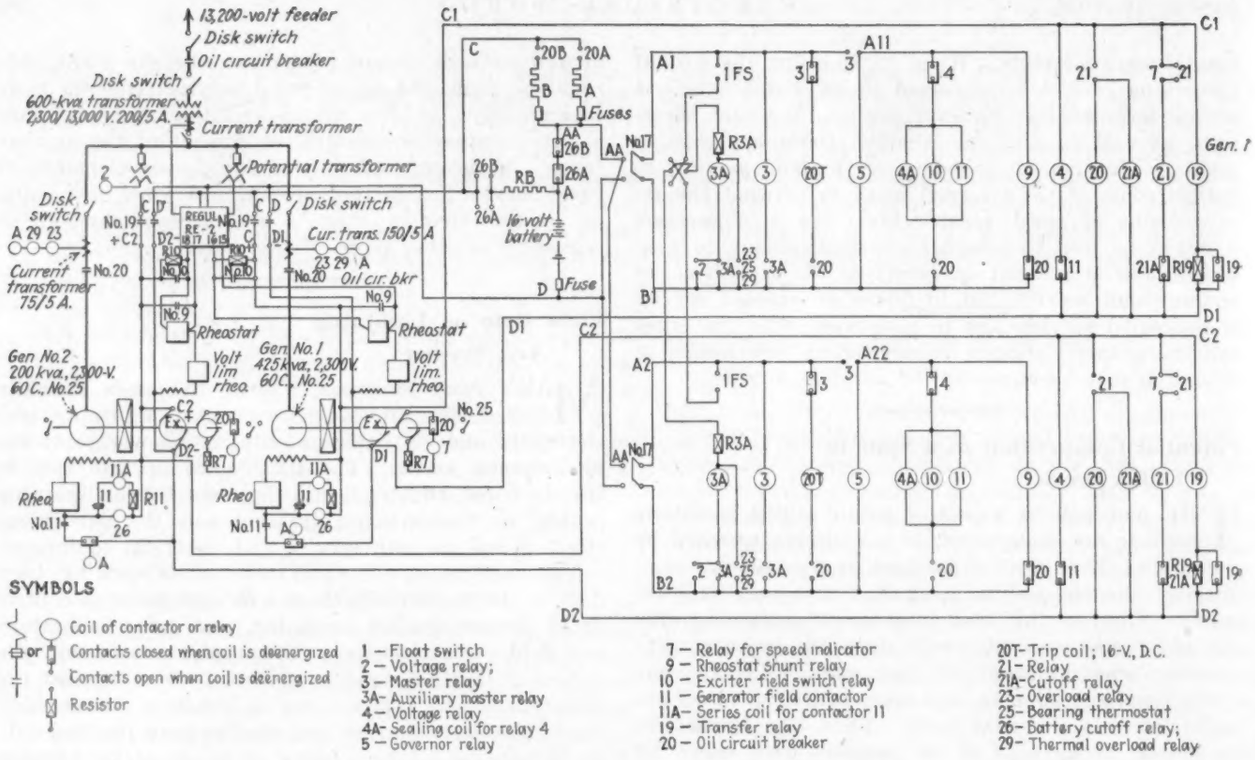
MANY years have passed since Benjamin Franklin risked his life to discover that lightning was electricity and yet little quantitative knowledge of the phenomenon exists. The importance of this fact to the electrical industry lies in the disturbances lightning causes on transmission systems and the deleterious effect it has on both service and electrical equipment.

Yet much constructive and meritorious work has been done in development methods and equipment to control or to protect against lightning, and many laboratory and field researches have been made to ascertain the nature of lightning and to protect systems against the disturbances it causes. As a practical accomplishment these developments and studies have resulted only in introducing a larger factor of safety at the expense of investments in protective equipment.

Today contradictory reports, opinions and experiences have had the effect of making many operating engineers question the efficacy of lightning protective equipment and the truth of the assertions made by specialists on the character of lightning disturbances. They acknowledge the need for more complete data.

On a grand average basis American experience shows that it pays to install arresters on systems using voltages up to about 66,000, but a wide divergence of opinion exists as to their economic value on high-voltage installations. In Europe a very large number of systems operate without lightning arresters, and at the recent World Power Conference their value was seriously questioned by prominent European specialists and operating engineers. And, aside from arresters, the use or non-use of a ground wire has been the subject of controversy for many years and still rages with unabated fervor. The key to the whole question lies in getting definite quantitative data on lightning itself. Peek, Norinder and Creighton now agree as to the approximate voltage gradients involved in lightning discharges but disagree as to the nature of the wave front, the value of the frequency and the amount of energy involved. Recent articles and letters in the ELECTRICAL WORLD by Norinder and Creighton indicate quite radical disagreements in these respects and the notable paper by Peek in the August *Journal of the A. I. E. E.* records an in-between position.

With such divergent opinions existing between the foremost specialists in the subject, more conclusive data must be obtained if the art in its practical aspects is to develop along lines which are correct. And until the nature of lightning itself is determined it would seem impossible to rely wholly upon experimental results obtained with artificial lightning produced in the laboratory because there is a question as to whether true lightning is produced. Actual field investigations should be made and fortunately the men and the equipment are now available to obtain data which are detailed, quantitative and reliable.

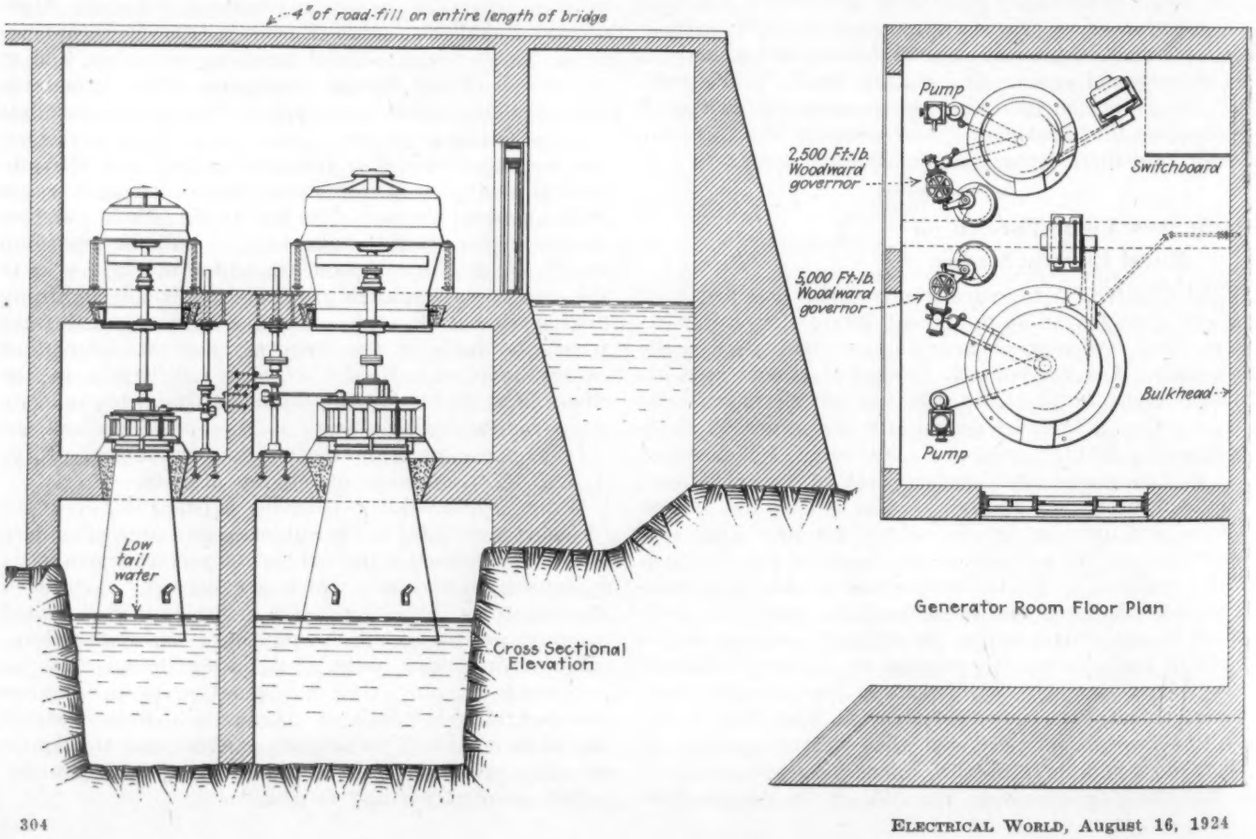


Dam, Bridge and Building in One Structure

AUTOMATIC hydro-electric stations have proved very satisfactory in this country, and many new installations have been recorded this year. Each station has a design which conforms to local conditions, and in this respect, the Great Works plant of the Berwick & Salmon Falls Electric Company is decidedly unusual.

This 625-kva. station, a dam and a bridge form one structure. A gravity-type concrete dam and a reinforced concrete bridge of 15 tons capacity were adopted as most economical, and the generating station was built under the bridge with the deck forming the roof. Two bridge piers formed the station end walls and the bulkhead formed the upstream wall, so that only a downstream wall was required to complete the station. The plan and cross-section of the station are given in the lower illustration.

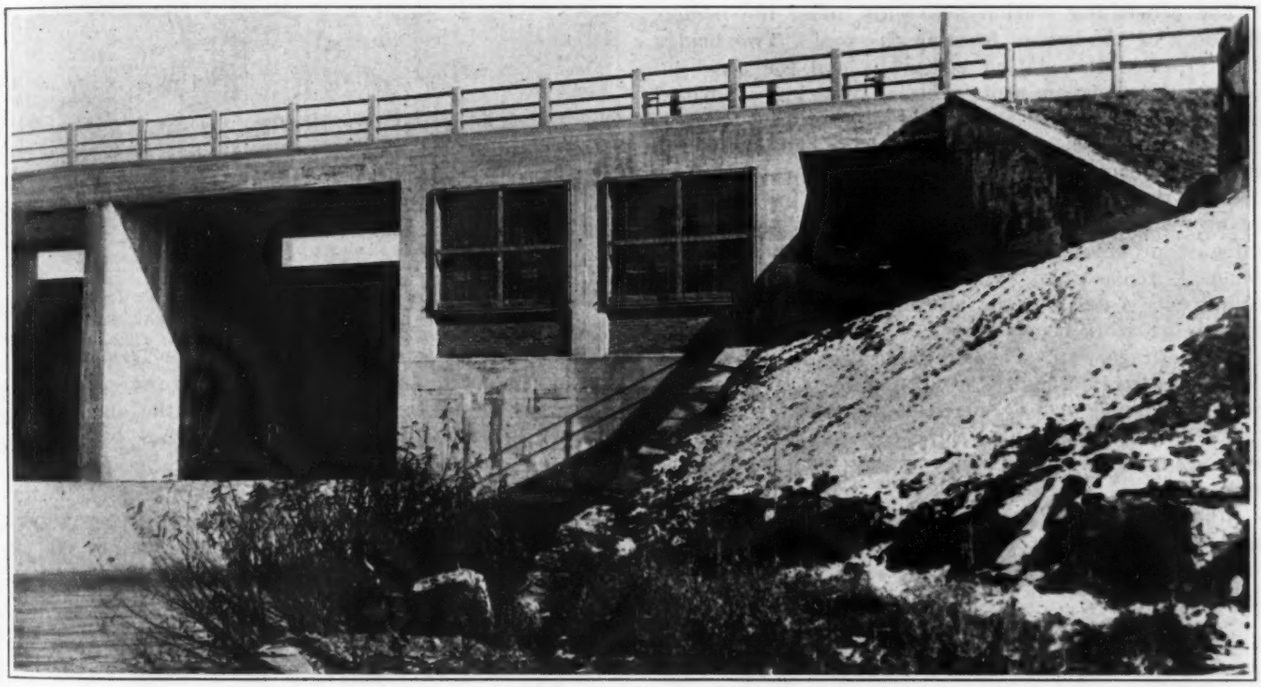
The upper view shows a single line diagram of the station wiring. The station comes into service automatically under control of a float switch.



Great Works Hydro-Electric Plant Has Original Design

New Automatic Station Constructed by Combining Dam, Bridge and Building Parts for Triple Use — Development Cost per Kilowatt About $284—How Interesting Engineering Problems Were Worked Out

By R. J. ANDRUS
Chief Engineer Twin State Gas & Electric Company, Boston



OPERATING ROOM, DAM AND HIGHWAY BRIDGE WERE BUILT INTO ONE STRUCTURE

A NUMBER of interesting engineering problems were involved in the design of the recently completed Great Works hydro-electric plant of the Berwick & Salmon Falls Electric Company, a subsidiary of the Twin State Gas & Electric Company, of Dover, N. H., which is a Middle West Utilities property in New England. The lines of the Berwick company connect with the transmission system of the Twin State company, the latter buying the entire hydro-electric output of the former, with an arrangement under which primary steam generated energy is furnished when necessary by the Twin State to the Berwick company. The new plant, rated at 625 kva., takes advantage of surrounding conditions in a somewhat unusual way, and some of the features of the installation are described below.

The Great Works River has a drainage area of about 85 square miles, in large part marshy land. In its lower reaches it falls precipitously and discharges into the Piscataqua River, which in turn reaches the sea at Portsmouth, N. H. The only storage on the Great Works is Bauna-Beg Pond, which has an area of 500 acres. The new station is about 7 miles east of Dover.

A geological fault, resulting in a natural fall in the riverbed of about 6 ft., with a ledge underlying the entire site, exists at the plant location. A gross normal operating head limited to 30 ft. by tailwater elevation in an adjoining upstream development was obtained by the construction of a dam 22 ft. high. This created a pondage of 40 acres, permitting the conversion of twenty-four-hour low stream flows into short-period peaks and enabling the system to receive its energy supply at higher load factors and with corresponding rate benefits. The Berwick company also operates a 1,200-kw. hydro-electric station on the Salmon Falls River at South Berwick, Me., this plant being a manually operated installation and about 0.6 mile from Great Works.

A bridge of stone masonry retaining walls and earth-fill construction which had failed several years before crossed the channel of the Great Works at about the location determined upon for the new development. The maximum head at the site would have been limited to 23 ft. if the original location and elevation of the bridge had been maintained and the dam built downstream from the bridge. Test borings indicated that a considerably longer and more expensive dam would be required if the dam and headgate structure were built

upstream. Studies showed that to provide a new bridge below the dam, with necessary alterations in road location and approaches, would cost more than a bridge superimposed on the dam itself. It was therefore decided to combine the dam, bridge and station building in one structure.

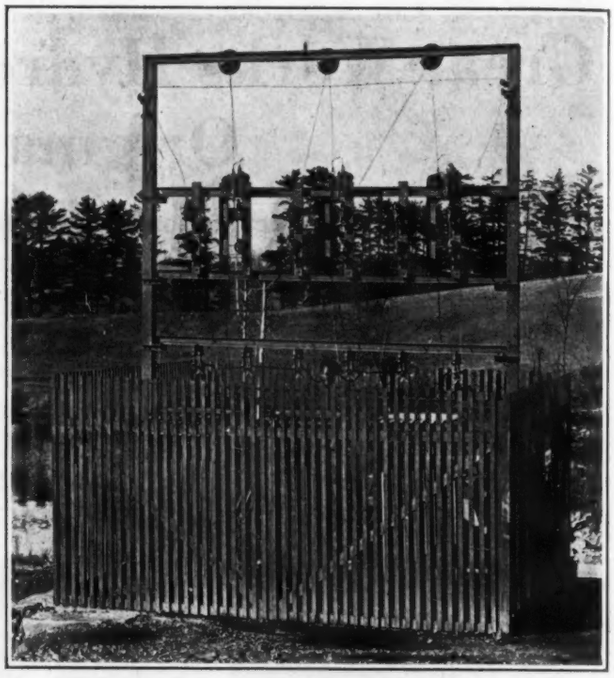
Computations showed that a gravity-type concrete dam was cheaper than a hollow type of dam because the "plums" from the retaining walls of the old bridge were available for use. A reinforced-concrete bridge of 15 tons capacity carried on reinforced-concrete piers was calculated as less expensive than steel. Solid piers for supporting the bridge deck worked out more economically than reinforced-concrete columns, owing to the less costly forming necessary with the solid piers.

The generating station was built under the bridge, the deck of the bridge forming the roof. Two bridge piers formed the station end walls and the bulkhead formed the upstream wall. The building was completed by the provision of a downstream station wall.

Between the bridge abutment and the end wall of the station a room 10 ft. wide, closed on three sides and open on the downstream side, was left. This space can be protected from the weather by a drop canvas curtain; it provides access to the building, permits the removal, replacement or major repair of any of the equipment, if desired, and affords convenient space for oil storage, work bench, etc.

The tailrace was excavated for a distance of 350 ft. below the station and is protected by a fender wall built of a double wall of the cut-stone masonry removed from the old bridge. The space between the two stone walls was filled with material removed from the tailrace excavation.

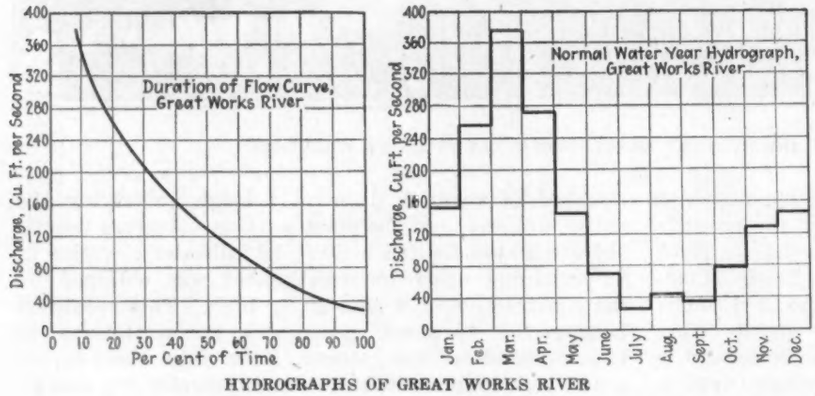
Studies indicated that the lowest total annual cost of energy, including fixed charges and transmission losses, would be obtained by making the Great Works station completely automatic, stepping up the generated energy at the station from 2,300 volts to the line potential of 13,200 volts used on the system, instead of operating the station by remote control.



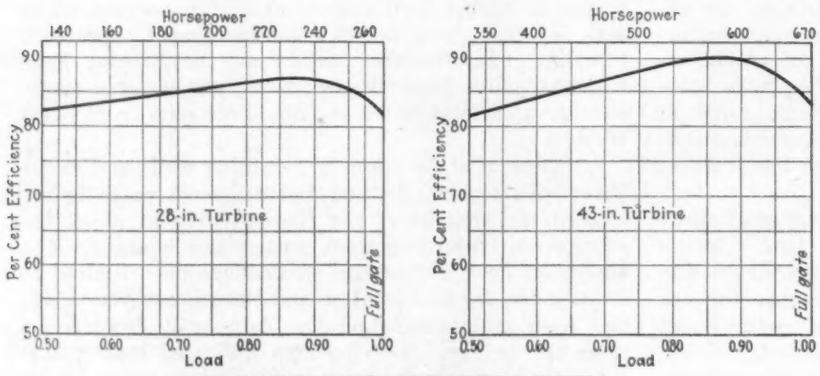
OUTDOOR SUBSTATION TYING PLANT INTO LINE CONNECTING WITH MANUALLY OPERATED STATION NEAR BY

Symmetry was sacrificed in the generator-room floor layout in order to hold the dimensions of the station within the limits imposed by the bridge structure. The generators are on a common downstream line, and the governors and oil-pressure tanks align reasonably well; but it was impossible to make a symmetrical layout of the exciters, which are driven by quarter-turn belts. Belt-driven exciters were selected on account of economy in first cost, and, with daily inspection provided for, no operating difficulties with belts have been experienced.

One 425-kva. and one 200-kva. generating unit are installed, each consisting of a Westinghouse 2,300-volt alternator of the vertical umbrella type, driven by a Leffel turbine. The turbines are 43-in. and 28-in. machines, type "F." The units are equipped with Kingsbury thrust bearings and oil-pressure-operated brakes. The wheels were selected to obtain the benefits of a runner efficiency at or above 80 per cent over a range of load from 100 kw. to full output. Woodward oil-pressure governors control the wheels. The Westinghouse company also supplied the exciters and the automatic switchboard. A delta-star outdoor substation was provided for handling the energy stepped up to 13,200 volts


Duration of Flow Curve, Great Works River
Discharge, Cu. Ft. per Second
Per Cent of Time
Normal Water Year Hydrograph, Great Works River
Discharge, Cu. Ft. per Second
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

HYDROGRAPHS OF GREAT WORKS RIVER



EFFICIENCY CURVES OF TURBINE RUNNERS

COST OF GREAT WORKS DEVELOPMENT

	Item	Quantity and Unit	Unit Price	Total
1.	Preparing site			$900.00
2.	Earth excavation			
3.	Gravel excavation	3,315 cu.yd.	$1.50	4,973.00
4.	Boulder excavation			
5.	Hard-rock excavation	890 cu.yd.	6.60	5,874.00
6.	Mass concrete	3,120 cu.yd.	9.15	28,548.00
7.	Reinforced concrete	753 cu.yd.	12.35	9,300.00
8.	Reinforced steel	42 tons	90.00	3,780.00
9.	Forms	47,000 sq.ft.	0.23	10,810.00
10.	Earthfill	5,400 cu.yd.	1.10	5,940.00
11.	Iron and steel work			1,135.00
12.	Installing equipment (no skilled labor included)			700.00
13.	Office expense (twenty-four weeks)			2,300.00
14.	Superintendence (Engineer and timekeeper twenty-four weeks)			3,500.00
15.	Coffer dams, pumping, etc			3,500.00
16.	Riprap and stone walls			1,500.00
17.	Brickwork			60.00
18.	Waterproof bridge			175.00
19.	Road fill			75.00
20.	Hard pine for gates, etc			475.00
21.	Steel sash and doors			400.00
22.	Expansion joints			175.00
23.	Bond			1,300.00
	Structural total*			$85,420.00

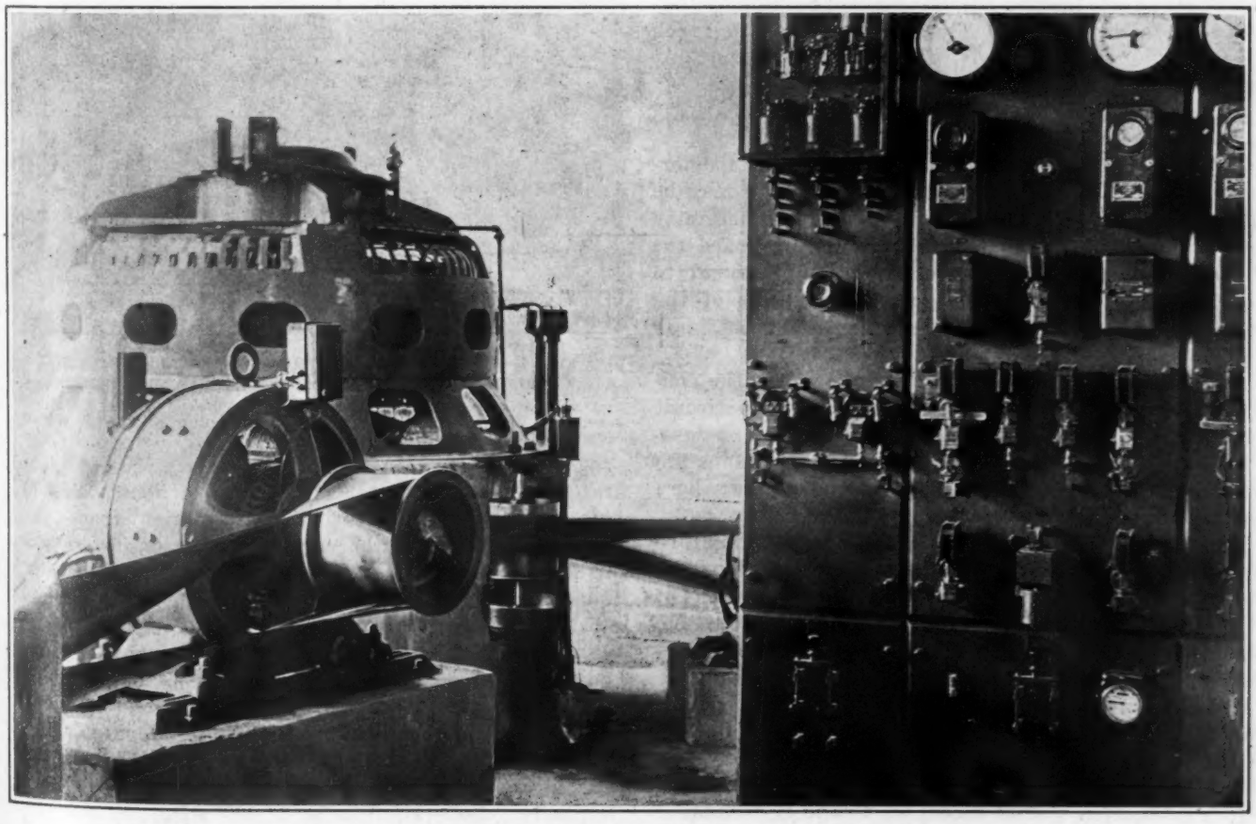
* The total cost of the station was $133,605, including flowage rights, construction contract itemized above, equipment including substations and transmission lines. The estimated annual output from the station is 1,650,000 kw.-hr.

for transmission to the South Berwick station bus, and at the latter plant outdoor, automatic, high-tension circuit breakers, with the necessary switchboard panel, relays, indicating and recording instruments, are provided.

The station normally comes into operation under float-switch control actuated by water level in the forebay. A master switch, leaving the float control operative or inoperative, is left in the open or closed position by the South Berwick station attendant at the time of his daily visit. Protection is afforded by the automatic equipment against excessive temperatures of generator thrust and guide bearings, excessive temperatures of exciter bearings, overspeed, breakage of governor belt, loss of field and overload on alternating-current generators. The wheel governors are equipped with adjustable gate-limit stops the setting of which is varied to correspond with river-flow conditions at the time of daily inspection.

The sequence of operation is as follows: With the master switch closed on either or both machines and with water levels in the pond at sufficient height so that float switches are in a closed position, if the outdoor high-tension oil circuit breaker at South Berwick is closed, one or both units at Great Works come on the line in the following manner: The governor solenoids are operated from a local 16-volt storage battery, one for each machine. With the transmission line energized, the governor solenoids are actuated and the governor opens the gate on the wheel. As the machine comes up to speed the exciter-field rheostat is short-circuited with the generator-field switch open. At a point just under synchronous speed, as indicated by a magneto bevel-gear driven from the governor shaft and connected with a type "TO" relay, the generator oil circuit breaker is closed and the machine connected to the busbars by direct current furnished from the exciter. Upon closing, the generator oil circuit breaker by means of the auxiliary contact opens the exciter field. When the exciter voltage drops to a predetermined point the generator-field switch closes; the exciter field is connected to the voltage regulator, and the machine, under the control of the governor, takes load.

All electrical and hydraulic equipment for the station was purchased directly by the owners. The work of building all necessary structures and installing apparatus was let on a firm bid basis to a general contractor. Itemization, as required by the specifications and submitted in the proposal of the successful contractor, is shown in the tabulation.



GENERATOR, AUTOMATIC CONTROL BOARD AND EXCITER WITH QUARTER-TURN BELT DRIVE TO REDUCE BUILDING CONSTRUCTION COSTS

Short-Circuit Calculating Board

Baltimore Company Designs Table for Two Interconnected Systems of 210,000 Kw.—Arrangements for Metering, Method of Applying Voltages, Operation and Use of Board Discussed

By L. G. SMITH
Assistant to Electrical Engineer Consolidated Gas, Electric Light & Power Company of Baltimore

ON AN electrical transmission system of large size an accurate knowledge of short-circuit conditions is an essential detail to be considered in its design and operation. For systems of the present degree of complexity the calculation of short circuits becomes a tedious and error-provoking process. By effecting an actual physical representation of the system in miniature by means of a system calculating board short circuit currents may be measured to scale and the actual currents readily determined.

A comprehensive and accurate knowledge of short-circuit conditions, such as total currents and the division of current among the various cables, transformers, generators, etc., is necessary for the proper selection of oil switches, the checking of the setting of relays and as a consideration in the choice of desirable operating connections. A step in the investigation of interruptions involves an analysis of the short-circuit currents. After interruptions the operation of the relays should be checked in order to insure the maximum reliability to service for future short circuits or grounds.

Short-circuit calculations are at best tedious computations, and results therefrom cannot be obtained with the facility desired. Thus a scheme by which such results may be obtained without necessitating any amount of laborious calculations is much desired.

USE OF SHORT-CIRCUIT CALCULATING BOARD

Once the constants of the system have been determined, an actual physical layout in miniature may be effected so that the actual conditions of the system may be simulated. In a short-circuit calculating board the system is represented by resistances proportional to the reactance of the various component parts of the system. The operation in determining a current is as follows:

1. Connect the resistances so as to simulate the configuration of the system for which the short circuit is desired.

2. Apply direct-current voltages proportional to the normal system to ground voltage at the points where the generators are represented.

3. Make a "ground" at the point on the miniature network to the other pole of the applied direct-current voltage.

4. The current measured will be proportional to the actual short-circuit current. As the factor of proportionality is easily determined from the value of resistances used and the applied voltage, the actual current may be quickly calculated.

The system to be reproduced in this case by the short-circuit calculating board was a 25-cycle, 13,200-volt transmission system belonging to the Consolidated Gas, Electric Light & Power Company. Power is generated at a steam generating station of about 125,000 kw. capacity at Westport. Transmission from the generating station to the various substations is accomplished by means of 13,200-volt underground cables. Transmission from this station to one of the larger substations is by means of 26,000-volt submarine cables, the voltage being stepped up at the generating station and then stepped down at the substation by means of auto-transformers.

Power is purchased from a company operating a hydro-electric generating plant of about 85,000 kw. capacity on the Susquehanna River, 40 miles from Baltimore. Generation is at 11,000 volts, the voltage being stepped up to 70,000 and transmitted to the

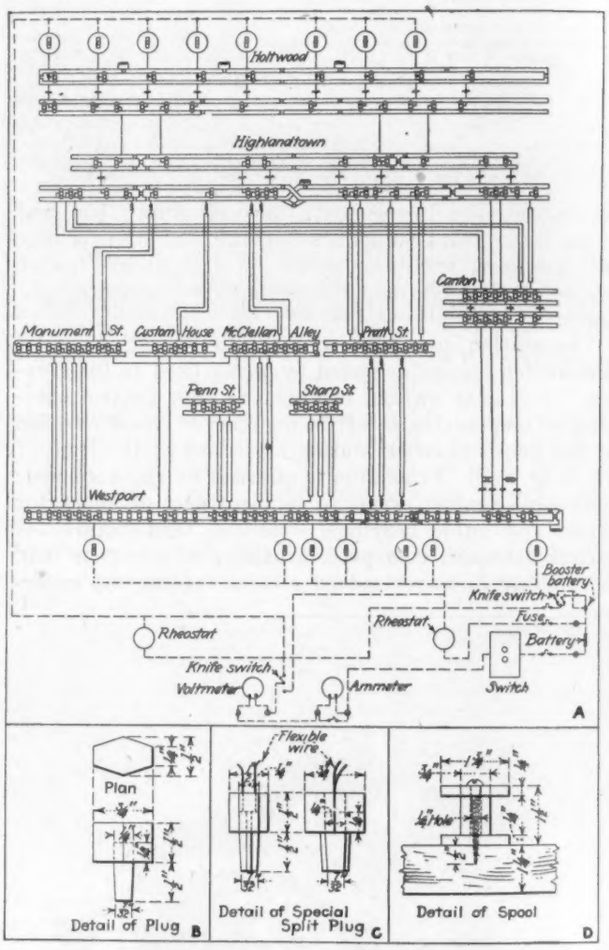


FIG. 1—CONNECTIONS OF THE TWO POWER SYSTEMS REPRODUCED ON SHORT-CIRCUIT CALCULATING BOARD

A shows the connections of the complete board, *B* the detail of connecting plug, *C* the detail of special split plug, and *D* the detail of a resistance spool.

Highlandtown substation in Baltimore over four 70,000-volt transmission lines. At this substation the voltage is stepped down to 13,200 volts so that the system of the hydro-electric company may be tied to the Baltimore underground transmission system. Fig. 1 shows the connections of the two systems which were reproduced on the short-circuit calculating board.

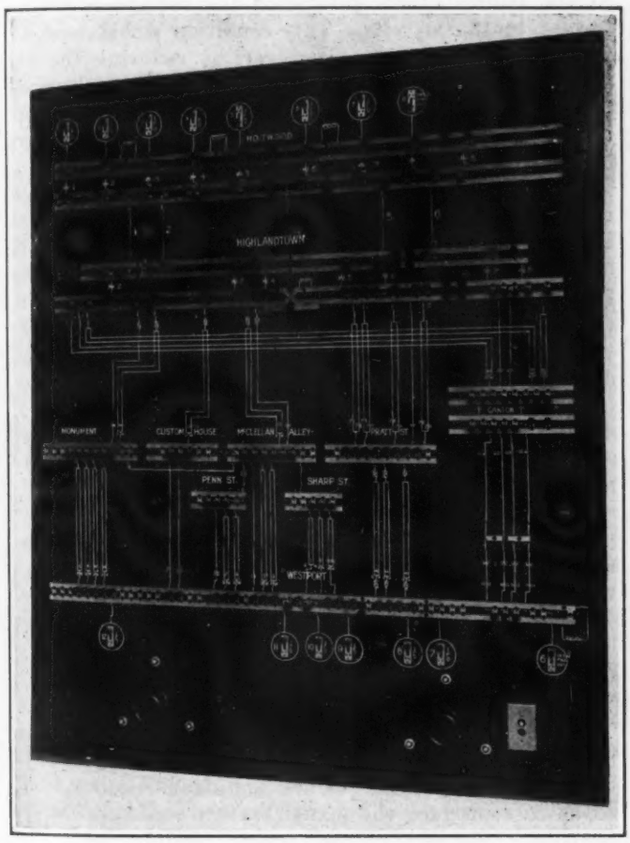
DESIGN OF BOARD

In the consideration of the most desirable type of board to be adopted designs were submitted by the manufacturers and several designs were investigated. The board proposed by one manufacturing company consisted of a large number of adjustable rheostats which may be connected so as to conform to any desired configuration by means of telephone plugs and jacks. This method has the advantage of extreme flexibility but requires a highly trained technical operator and has a very high first cost.

The scheme adopted was an original one in which the board was an exact replica of the system. It consists of a wooden panel, 6 ft. x 5 ft. x 1¼ in., on which are mounted the miniature buses of the various stations, together with the plugging arrangements for imitating the switching; the resistance coils representing the various cables, generators and other apparatus; the necessary connections, which are a replica of the 25-cycle systems of the Consolidated Gas, Electric Light & Power Company and the Pennsylvania Water & Power Company, and the necessary control for regulating the voltage across the resistance coils representing the generators.

Each station is shown by two brass straps, nickel-plated, representing the double bus arrangement used. Provision is made for plugging a resistance coil representing a cable, transformer or generator into either miniature bus. Thus any operating connection may be obtained. Fig. 1 illustrates the layout of the board. Fig. 2 (front of board) and Fig. 3 (rear of board) show the completed board. Lines representing cables and transmission lines and symbols representing other apparatus are painted in white on the face of the board. Thus the entire system is readily noted by the operator of the board. In order to insure good mechanical fit of the plugs in the holes, the straps representing the station buses are mounted upon formica inserts mounted on the wood panel.

The resistors are wound upon fiber spools which are mounted on the rear of the board. A separate coil is provided for each cable and piece of apparatus represented. In order to insure a constant accuracy uninfluenced by temperature changes a special wire having virtually a zero temperature coefficient was used in winding the coils.



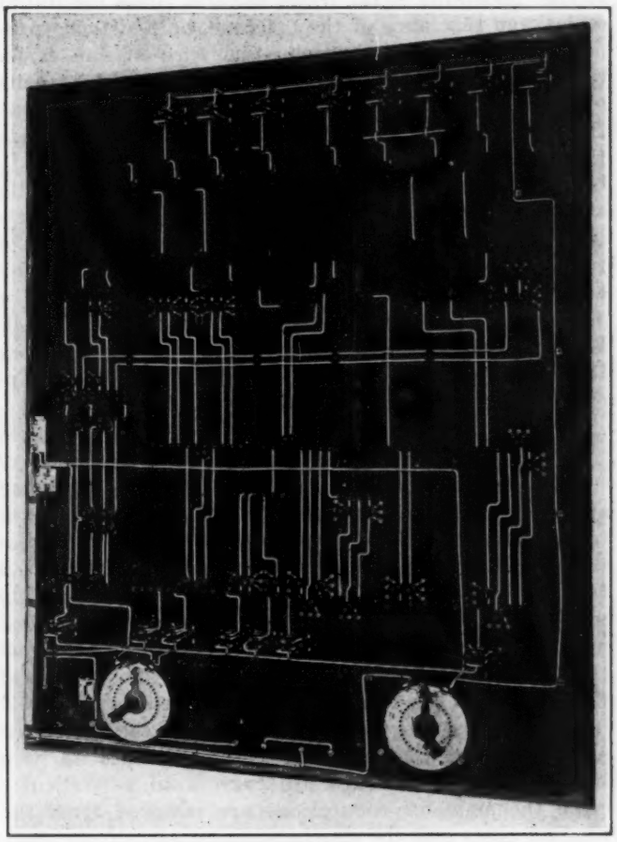


FIG. 2 AND 3—FRONT AND REAR VIEWS OF SHORT-CIRCUIT CALCULATING BOARD

The resistance of a coil representing a piece of apparatus was wound equal to one hundred times the reactance of the same coil, since the reactance of this class of apparatus constitutes the greater portion of its impedance. In the case of the cables the reverse is true. Owing to the small spacing of the conductors in a cable the reactance is small, the resistance predominating. If the reactance were used for cables, the short-circuit current would be high, the error in some cases being as great as 20 per cent. If the scaler value of impedance or the resistance were used, the short-circuit current measured would be low.

A large number of short-circuit currents were calculated for grounds at various locations on the system using the reactance only of cables, the scaler impedance, the resistance, and finally with weighted averages of the resistance and impedance. In each case the results were checked against those obtained by vector calculations. An effective value of reactance obtained by giving the reactive component double the weight of the resistance, or $x_e = (r + 2x)/3$ for cables, was found consistently to give good results for a number of calculations, the error being always less than 2 per cent. Therefore the coils for the cables have a resistance equal to one hundred times the effective reactance of the cables.

Each coil representing a generator has a tap on it so that resistance equal to one hundred times the initial or leakage reactance of the machine, or resistance proportional to the synchronous reactance of the same, may be used. The switching is accomplished by means of a three-way telephone switch which is used to cut the coil for that machine out of the circuit, to use the initial value or the final value. This is done to take into consideration the short-circuit characteristic of an alternator. It is well known that the initial short-circuit current of a generator is limited by the leakage reactance only of the machine. However, with time the effect of armature reaction becomes apparent until a steady or final value of short-circuit current is reached. By using both initial and final values for the generators the initial currents and currents for steady short circuit may be determined by this board.

Arrangements for Metering

Provision is made for the connection of a voltmeter and an ammeter by means of binding posts at the bottom of the calculating board. A single-pole, double-throw switch is mounted on the rear of the board so that the best potential on the miniature Holtwood bus may be measured or the potential on the Westport bus may be determined. The dotted lines on Fig. 1 show the connections made on the rear of the panel and illustrate how the two voltages are measured.

A switch is provided on the rear of the panel for short-circuiting the ammeter binding posts. In case it is desired to measure the current in a particular cable the ammeter connections are removed from the binding posts and the short-circuiting switch is closed. The ammeter is then connected to the leads from the special plug shown in *A* of Fig. 1, and the plug is placed in circuit, for which a measurement of the current is desired.

It was found that in order to reproduce the normal operating conditions a much higher voltage was required on the Holtwood bus than for the Westport bus. In order to obtain this condition without increasing the range of the rheostats, the battery was tapped at an intermediate voltage, the lower voltage being supplied to the Westport bus and the higher voltage to the Holtwood bus. The connections for this scheme, together with two single-pole switches used for varying the voltage on the Holtwood bus, are shown in Fig. 1. For the energizing of this calculating board a battery of dry cells has proved quite satisfactory.

Method of Applying Proper Voltages to Buses

The board was designed to operate on 7.62 volts, or just one one-thousandth of the normal system voltage from phase to ground. Therefore the source of supply may be a 12-volt storage battery or a battery of dry cells. Normally this value of voltage will be sufficient for the Westport bus, and only enough cells of the battery should be used to give a voltage slightly greater than 7.62. However, under certain conditions a greater voltage than this value must be applied to the bus at Holtwood. This is accomplished by an end cell switching arrangement. A very close adjustment of voltages is obtained by rheostats in series with each bus.

Generation at Westport is at 13,200 volts. At Holtwood, the hydro-electric plant on the Susquehanna River, power is generated at 11,000 volts. This is stepped up to 70,000 volts and transmitted at this voltage to Baltimore, a distance of approximately 40 miles. At the Highlandtown substation the voltage is transformed to 13,200 volts. This condition would tend to complicate calculations. However, by reducing the reactance of the various component parts of the Holtwood-Highlandtown section of the system to 13,200-volt values, the voltage of 7,620 volts to ground may be used on the Holtwood generators.

This assumption is correct only in case the voltage at Holtwood is such that it will give a voltage of 13,200 at Baltimore at no load and consequently with no line drop. To compensate for the line drop the ratio of the Holtwood transformers is 11,000/70,000 volts, while that of the Highandtown transformers is 60,000/13,200 volts. The combined ratio of the transformers interconnecting the two systems is 0.682. Thus a voltage of 9,430 volts at the Holtwood generators will give a voltage of 13,200 at Baltimore. Therefore, if the generated voltage at Holtwood is other than 9,430 volts across phases, the actual voltage to be used for Holtwood must be corrected by multiplying 7.62 volts by the ratio of the actual generated voltage to the normal 9,430 volts. This corrected equivalent value of voltage will be used for the Holtwood generators and the normal value of 7.62 volts will be used for the generators located at Westport.

Operation of the Board

The first step in the operation of this board in the determination of a short-circuit current is to plug in the various apparatus, cables and transmission lines so as to reproduce the actual system configuration in question. Connect to the proper binding posts the voltmeter and ammeter as shown in Fig. 1. Insert the grounding plug, which consists of a standard plug to which a long flexible wire is attached, in a hole in the bus at which the ground is assumed. The wire on this plug will be connected to the left ammeter binding post. The voltages are then regulated so that the proper values exist on the power station generators. The short-circuit current may then be read by the ammeter. The correction factor—that is, the number by which the actual current read will be multiplied to give the value of the predicted short-circuit current—will be 100,000.

The current in any particular cable or apparatus in the circuit may be measured by the use of a special split plug shown in Fig. 1. The leads from this special plug are connected to an ammeter. To determine the current in a certain cable or machine the special plug may be substituted for a standard one connecting the apparatus in question to the nearest bus. This plug consists of two halves insulated by micarta with one

lead wire attached to each half. Thus when it is inserted the current will flow from the bus through the ammeter to the apparatus.

This board has proved to be a virtual time saver in making determinations of short-circuit currents. With it calculations were made possible which it was not practicable to make before because of the complication and abnormally great amount of time involved. Using the special value of resistances for cables, a reasonably high degree of accuracy should be obtained, preliminary calculations showing an error of less than 2 per cent.

In addition to its use for the determination of short-circuit currents this board may be used for other calculations. Voltage conditions during short circuits may be obtained approximately. By grounding through resistances which simulate the load the division of currents under load conditions may also be determined.

Electrical Educational Institutions Get Closer to Industry

Ninety per Cent of Yearly Graduates Are from Colleges Giving Full Professional Courses—Salaries in Electrical Engineering Departments of Larger Institutions Are Below the Average of Salaries for All Teachers

THREE points stand out in any study of electrical engineering education today: First, the growth in number of students; second, the trend of engineering education in its relation to industry; third, the salaries paid to teachers. And these three phases are so interrelated that it is only by a study of them all that any conclusions as to the present status of electrical engineering education may be reached.

The ELECTRICAL WORLD through its annual survey of electrical engineering institutions is able to present statistics which help portray these three situations in a very definite manner, and a study of the accompanying tabulations and diagrams will pay any one who desires to make an analysis. In order that a more comprehensive analysis may be made of the situation, the electrical engineering colleges of the country have been divided into three arbitrary classes or groups in the following manner:

Group I—Colleges whose electrical courses have the highest standing, whose teaching equipment is most complete and whose degree is recognized as conferring a certain prestige on the graduate. From this group have also been selected the ten colleges of the country having outstanding electrical engineering courses based upon equipment and teaching force.

Group II—All other colleges whose electrical engineering courses require all the student's time as distinct from those where the student may carry on some other occupation at the same time.

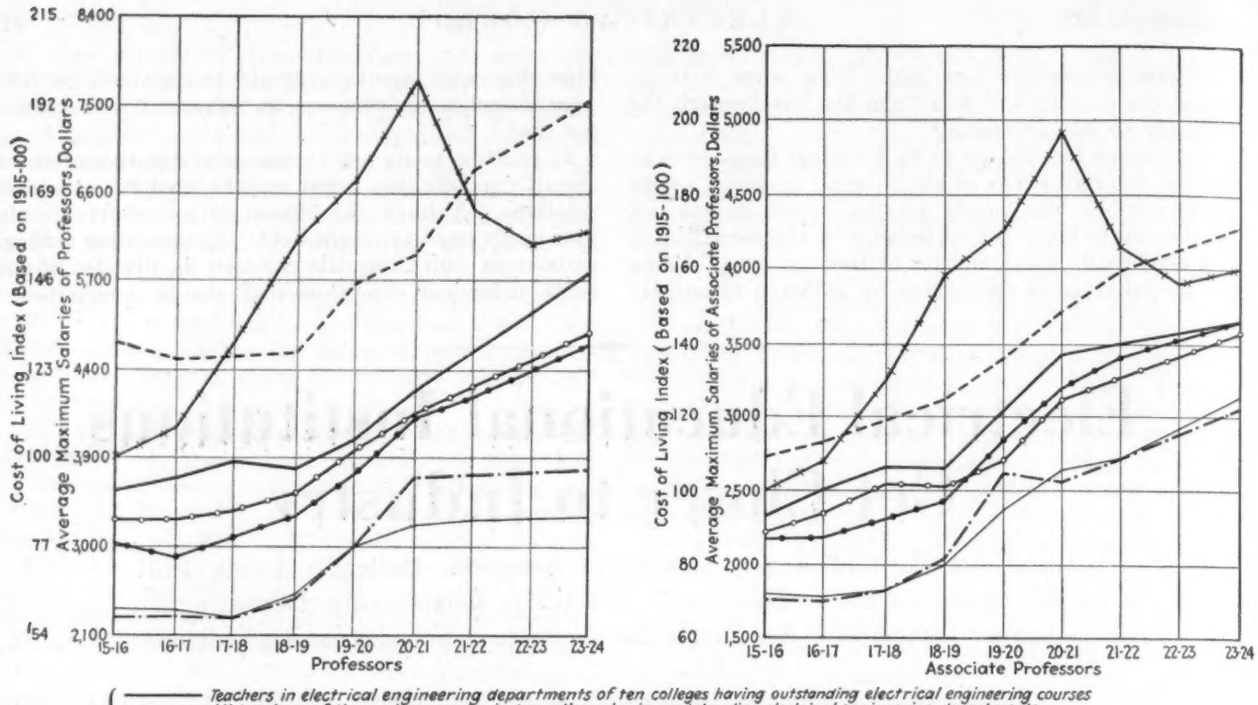
Group III—Educational organizations of a trade-school nature having an organized course on electrical subjects in which the instruction is quite elementary from a professional standpoint and as a rule is arranged for evening class work.

The history of attendance and graduation from the electrical engineering colleges and schools of the country is clearly indicated in Table I. Only the students registered in the junior and senior classes are included in tabulation since, as indicated in Table II, in the large majority of the engineering colleges the students do not definitely select the branch of engineering in which they wish to specialize until the beginning of the junior year. The indications are that almost three thousand students graduated from the electrical engineering schools of the country this June, of whom approximately 90 per cent came from colleges giving full professional courses. The data indicate a slight drift toward institutions with the best equipment and teaching force. In 1916 23.9 per cent of the total number of graduates were from the ten leading electrical engineering colleges, and in 1923 this had increased to 24.8 per cent. Colleges in Group II also show a slight gain during this period.

The trend of electrical engineering education in its

TABLE I—THE HISTORY OF ATTENDANCE AND GRADUATION FROM THE ELECTRICAL ENGINEERING COLLEGES AND SCHOOLS OF THE COUNTRY—1915-1924

College Year	Juniors					Seniors					Graduates at End of Year				
	In Ten Colleges Having Outstanding Electrical Engineering Departments	Group I	Group II	Group III	Total in Three Groups	In Ten Colleges Having Outstanding Electrical Engineering Departments	Group I	Group II	Group III	Total in Three Groups	In Ten Colleges Having Outstanding Electrical Engineering Departments	Group I	Group II	Group III	Total in Three Groups
1915-1916	551	1,302	669	265	2,236	442	1,012	501	186	1,699	357	880	453	162	1,495
1916-1917	436	1,113	656	238	2,007	452	1,090	512	231	1,833	374	886	438	203	1,527
1917-1918	328	793	589	275	1,657	290	719	441	194	1,354	276	602	368	164	1,134
1918-1919	387	906	604	268	1,778	196	535	415	175	1,125	192	472	338	155	965
1919-1920	639	1,373	795	242	2,410	352	931	471	237	1,639	289	789	408	200	1,397
1920-1921	724	1,615	931	264	2,810	437	1,061	580	239	1,880	366	910	479	206	1,595
1921-1922	1,019	2,222	1,043	360	3,625	625	1,407	695	255	2,357	567	1,237	746	227	2,210
1922-1923	915	2,022	1,035	300	3,357	700	1,615	883	287	2,785	605	1,421	767	253	2,441
1923-1924	883	1,988	1,144	330	3,462	778	1,742	923	290	2,958	....	....	....	....	....
Increase 1915-1924	332	686	475	65	1,226	336	730	422	104	1,256	248	541	314	91	946
Per cent increase	60.3	52.7	71.0	24.5	54.9	76.1	72.1	84.2	56.0	74.0	69.4	61.4	69.2	56.2	63.3


Cost of Living Index (Based on 1915-100)
Average Maximum Salaries of Professors, Dollars
Professors
Cost of Living Index (Based on 1915-100)
Average Maximum Salaries of Associate Professors, Dollars
Associate Professors
LEGEND
Teachers in electrical engineering departments of ten colleges having outstanding electrical engineering courses
All teachers of the various grades in ten colleges having outstanding electrical engineering departments
Teachers in electrical engineering departments of colleges classed in group I (See text for grouping)
All teachers of the various grades in colleges classed in group I
Teachers in electrical engineering departments of colleges classed in group II
All teachers of the various grades in colleges classed in group II
Index of cost of living (National Industrial Conference Board)

COST OF LIVING AND TEACHERS' SALARIES COMPARED

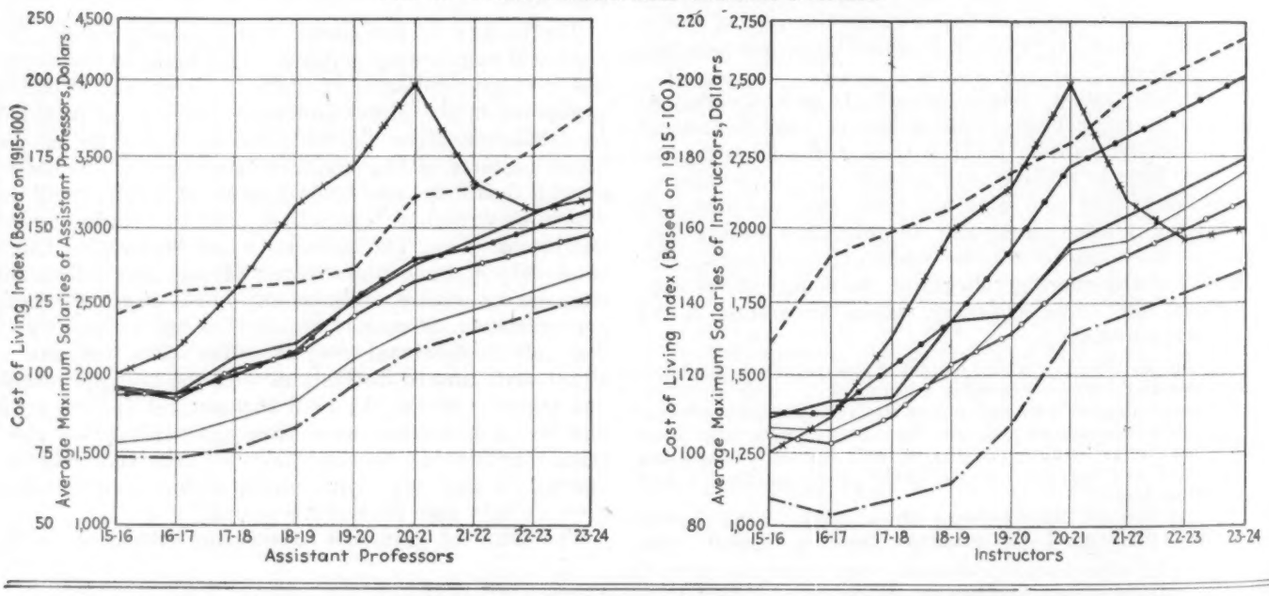

Cost of Living Index (Based on 1915-100)
Average Maximum Salaries of Assistant Professors, Dollars
Assistant Professors
Cost of Living Index (Based on 1915-100)
Average Maximum Salaries of Instructors, Dollars
Instructors

TABLE III—COMPARISON OF AVERAGE MAXIMUM SALARIES PAID TO ALL TEACHERS IN AMERICAN UNIVERSITIES AND COLLEGES

College Year	All Professors in Universities and Colleges			Professors in Electrical Engineering Departments			All Associate Professors in Universities and Colleges		
	In Ten Colleges Having Outstanding Electrical Engineering Departments	Colleges in Group I	Colleges in Group II	In Ten Colleges Having Outstanding Electrical Engineering Departments	Colleges in Group I	Colleges in Group II	In Ten Colleges Having Outstanding Electrical Engineering Departments	Colleges in Group I	Colleges in Group II
1919-1916	$5,093	$3,023	$2,360	$3,587	$3,259	$2,287	$2,732	$2,171	$1,801
1916-1917	4,900	2,919	2,373	3,673	3,289	2,301	2,822	2,188	1,796
1917-1918	.....	.....	.....	3,864	3,388	2,295	.....	.....	.....
1918-1919	4,975	3,313	2,544	3,805	3,533	2,487	3,111	2,437	2,015
1919-1920	5,655	3,749	3,000	4,088	3,978	3,014	3,414	3,849	2,381
1920-1921	5,955	4,308	3,225	4,578	4,378	3,702	3,704	3,193	2,642
1921-1922	6,863	4,527	3,309	.....	.....	.....	3,975	3,411	2,720
1922-1923	.....	.....	.....	.....	.....	.....	.....	.....	.....
1923-1924	7,560	5,110	3,320	5,811	5,207	3,813	4,290	3,660	3,140
Increase 1915-1924	$2,467	$2,087	$960	$2,224	$1,948	$1,526	$1,558	$1,489	$1,339
Per cent increase	48.2	69.0	40.7	62.0	59.7	66.7	57.0	68.5	74.3

TABLE II—QUESTIONS PERTINENT TO ENGINEERING EDUCATION

(Figures refer to number of companies reporting)

College Group*	When Does Student Definitely Select Electrical Engineering Course?				Is a Special Course in Public Utilities Given?		Is a Special Course in "Administrative Engineering" or "Industrial Engineering" Given?		Any Industry-Endowed Professorships?		Any Course in Co-operation with Industries Similar to "Cincinnati Plan"?	
	Senior Year	Junior Year	Sophomore Year	Freshman Year	Yes	No	Yes	No	Yes	No	Yes	No
Ten outstanding colleges	0	3	4	3	3	7	5	5	3	7	2	8
Colleges in Group I	1	4	8	16	13	16	13	16	7	22	4	25
Colleges in Group II	1	12	19	32	15	49	27	37	6	58	6	58
Colleges in Group III	0	0	4	5	1	8	4	5	1	8	4	5

*See groups I, II and III on page 311.

relation to industry is indicated in Table II. There is a distinct movement throughout educational institutions toward closer relations and co-operation with industry, many institutions reporting courses in administration and industrial engineering and also co-operation similar to that embodied in the "Cincinnati plan." Fourteen colleges now have endowed professorships in electrical engineering. The following indicates what some electrical engineering colleges are doing to maintain closer contact with engineering in industry:

1. Commercial testing and lecturers drawn from industry.
2. Two advisory boards; a director of industrial relations; a board composed of representatives from the United States Bureau of Mines, coal operators, etc.
3. Actual experience required in public utility work before receiving bachelor's degree.
4. Actual assistance by teachers in engineering problems and technical society activities.
5. Lectures by practicing engineers; teachers active in branches of national societies.
6. Conducting research; operating an industrial plan.
7. Engineering experiment stations; short courses for metermen, ceramic workers and highway engineers.
8. Constant professional services rendered city and state.
9. Close contact with local manufacturers.
10. Minimum of eight weeks' work in electric shops in summer, with written report thereon, for three years.
11. Consultation work by teachers.
12. Maintenance of division called "division of industrial co-operation and research."
13. Research scholarship, engineering lecturers and co-operating committee.
14. Meter school; committee on industrial co-operation.
15. Loan equipment and conduct tests.
16. Advisory committee appointed by trustees, composed of leaders in state industries who are nominated by manufacturers' association.
17. Twelve weeks' "work in practice" required during summer; vacation at the end of the year.
18. One member of staff delegated to attend teachers' course given by manufacturing companies.
19. A co-operative director who maintains contact between college and industry.
20. A joint committee of school and industry, meeting once every month.

The question of teachers' salaries is dealt with in considerable detail in Table III. A comparison is here made between salaries paid to all teachers of various grades in colleges as a whole and teachers of these grades in the electrical engineering departments. The comparison is distinctly against the teachers of electrical engineering, especially in the ten outstanding colleges of the country. In other words, a teacher of engineering is not placed upon so high a plane as the teacher of some subjects in the non-professional courses. The colleges as a whole, however, do not appear to make much distinction between the teachers in the different courses. In fact, if anything salaries paid to teachers of electrical engineering are in the main higher than those paid to teachers as a whole. These conclusions are clearly brought out in the accompanying diagrams (see page 312).

Teachers' salaries have risen steadily since 1915, and the indications are that they are still on the increase. The "cost of living" index which has been plotted on the diagrams indicates, however, that salaries did not keep up with the rise in commodity prices, especially in 1921. On the other hand, salaries continued to rise after the cost of living had begun to decrease. At the present time the increases since 1915 are about on a par with the increased cost of living. This, however, does not detract from the fact that teachers' salaries are still far below those which should be paid to men of the education and experience required to give the highest grade of professional engineering instruction.

WITH SALARIES PAID TO TEACHERS IN ELECTRICAL ENGINEERING DEPARTMENTS OF THESE UNIVERSITIES AND COLLEGES

Associate Professors in Electrical Engineering Departments			All Assistant Professors in Universities and Colleges			Assistant Professors in Electrical Engineering Departments			All Instructors in Universities and Colleges			Instructors in Electrical Engineering Departments		
In Ten Colleges Having Outstanding Electrical Engineering Departments	Colleges in Group I	Colleges in Group II	In Ten Colleges Having Outstanding Electrical Engineering Departments	Colleges in Group I	Colleges in Group II	In Ten Colleges Having Outstanding Electrical Engineering Departments	Colleges in Group I	Colleges in Group II	In Ten Colleges Having Outstanding Electrical Engineering Departments	Colleges in Group I	Colleges in Group II	In Ten Colleges Having Outstanding Electrical Engineering Departments	Colleges in Group I	Colleges in Group II
$2,325	$2,209	$1,784	$2,433	$1,889	$1,564	$1,927	$1,904	$1,474	$1,718	$1,472	$1,341	$1,362	$1,290	$1,093
2,505	2,341	1,771	2,595	1,876	1,596	1,880	1,856	1,476	1,910	1,476	1,327	1,418	1,276	1,030
2,660	2,535	1,850	.....	.....	.....	2,108	2,049	1,531	.....	.....	.....	1,427	1,364	1,089
2,645	2,529	2,036	2,654	2,165	1,843	2,207	2,143	1,651	2,059	1,694	1,503	1,685	1,533	1,146
3,040	2,703	2,643	2,744	2,527	2,116	2,521	2,424	1,953	2,183	1,942	1,727	1,716	1,648	1,338
3,429	3,109	2,567	3,233	2,819	2,344	2,779	2,678	2,197	2,296	2,200	1,925	1,948	1,832	1,639
.....	.....	.....	3,281	2,888	2,303	.....	.....	.....	2,460	2,320	1,952	.....	.....	.....
3,660	3,570	3,047	3,820	3,120	2,720	3,274	2,964	2,548	2,630	2,520	2,200	2,230	2,098	1,870
$1,335	$1,361	$1,263	$1,387	$1,231	$1,156	$1,347	$1,060	$1,074	$912	$1,078	$858	$868	$808	$777
57.4	61.7	70.8	57.0	65.3	73.8	69.9	55.7	72.8	53.1	73.2	64.0	63.8	62.8	71.2

Hot Spots and Overload Indicators—I

Results of Studies Made by the Detroit Edison Company to Permit Utilizing Transformers More Effectively Without Incurring Serious Overheating of the Insulation

By HAROLD COLE
Distribution Engineer Detroit Edison Company

IT HAS been pointed out by several operating engineers that the limit to the load which may be carried by a transformer is determined only by the temperature of the hottest part of the windings. This temperature depends not only upon the amount of load on the transformers, but upon its duration, and also upon the temperature of the surrounding air. It has also been pointed out that transformers carrying load of low load factor may economically carry two or three times full rated load. The logical conclusion, therefore, is that the proper way to operate distribution transformers is to have some means of determining when the windings of the transformer have reached a dangerous temperature.

It is, of course, impracticable to measure the temperature of the windings of a transformer in service. About the only practical place to measure temperatures in a transformer is in the cooling oil. Several types of "overload indicators" have been developed which are designed to give an indication when the oil temperature has reached a certain predetermined limit.

With a view toward securing information that would enable the operation of transformers at their ultimate capacity without endangering serious overheating, the Detroit Edison Company conducted a series of tests to determine the location of the hottest spots in transformers, the best practical location for overload indicators, the thermal gradient between the hottest spot and oil, and the maximum safe loads for different seasons of the year. In addition, comparisons have been made of various overload indicators to ascertain their relative accuracy, visibility, durability, ruggedness

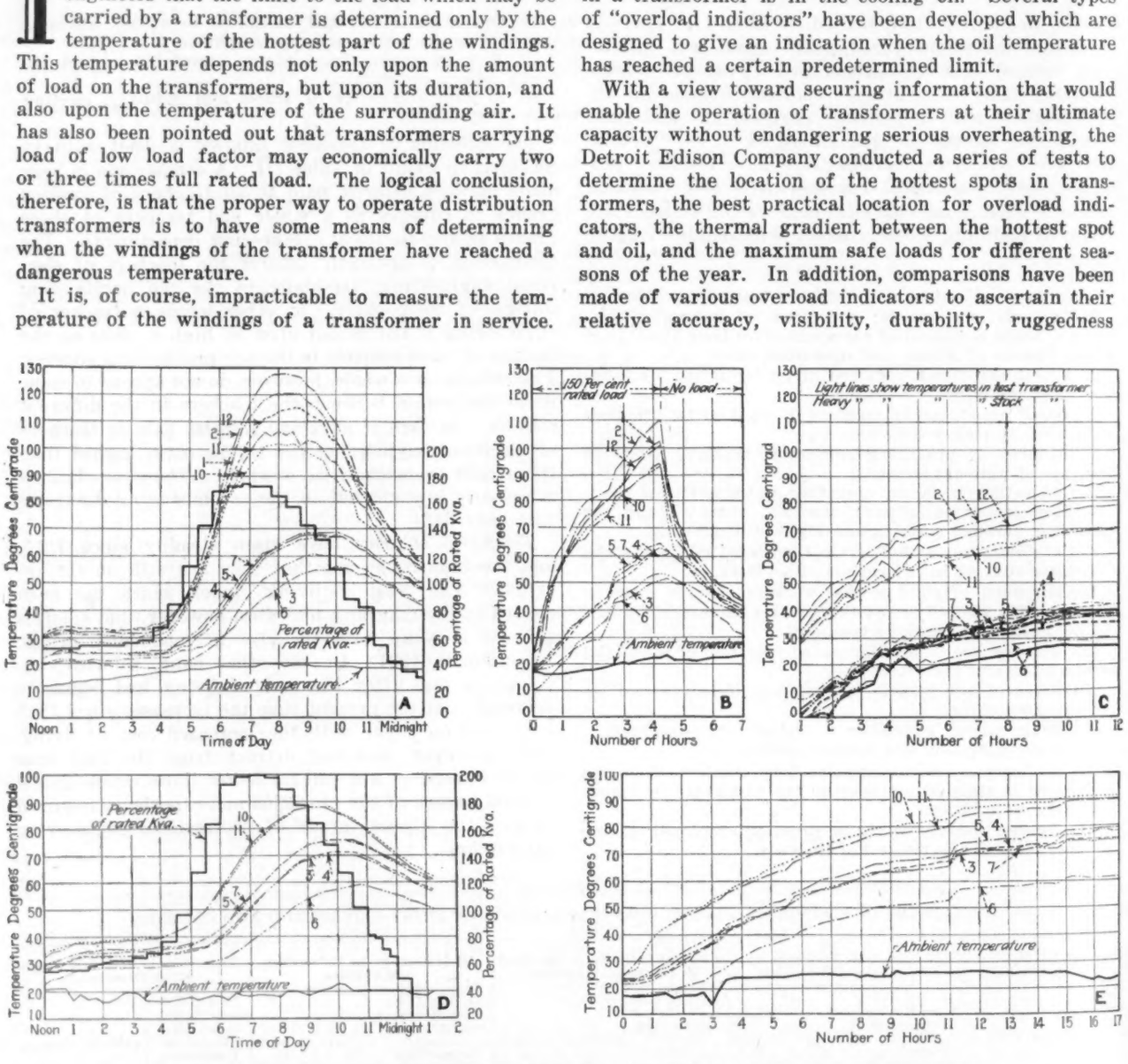


FIG. 1—TEMPERATURES AT VARIOUS POINTS IN 5-KVA. AND 25-KVA. CLOSED-COIL TRANSFORMERS AT 20 DEG. C. AMBIENT TEMPERATURE

Location of thermocouples (numbers refer to drawings above):

1. Between primary and inner secondary coils, midway between top and bottom.
2. Between primary and inner secondary coils, one-third way down from top of winding.
3. In oil, upper corner of case.
4. In oil, near top and midway between outer coil and side of case.
5. In oil, above winding and near core.
6. In oil, near bottom of shell.
7. In oil, at center of upper surface.
10. In center of primary winding, one-quarter way down from top of winding.
11. In center of primary winding, one-half way down from top of winding.
12. Between inner secondary winding and core, midway between top and bottom.

A—Conditions in a rewound 5-kva. transformer with a maximum load of 175 per cent rated kva.

B—Conditions in same transformer with constant load of 150 per cent of rated kva.

C—Comparison of 5-kva. closed-coil stock and test transformers at constant load 135 per cent of rated kva.

D—Conditions in 25-kva. closed-coil transformer with a characteristic load reaching 200 per cent of rated kva.

E—Condition in same transformer as in *D*, but with a constant load of 150 per cent of rated kva.

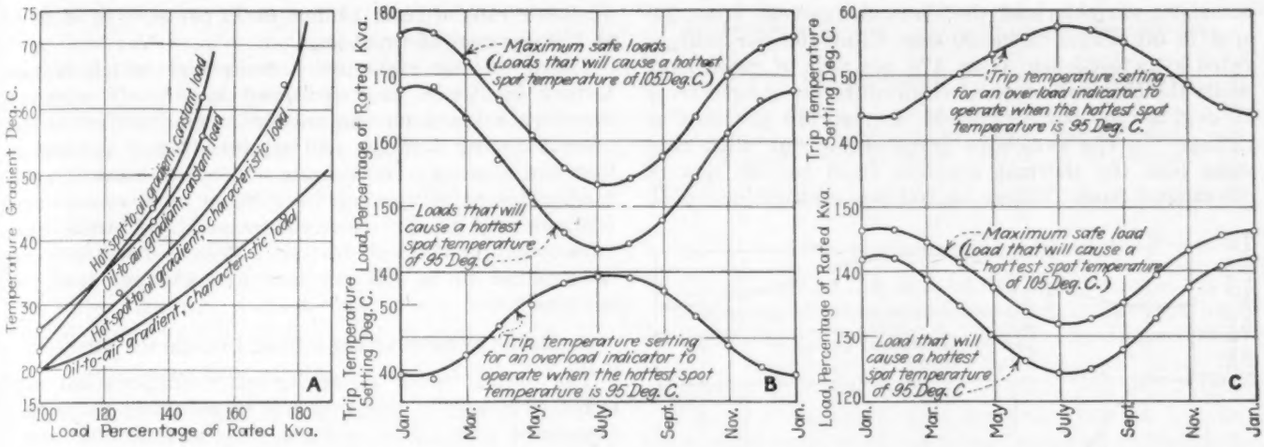

Temperature Gradient Deg. C.
Load Percentage of Rated Kva.
Hot-spot-to-oil gradient, constant load
Oil-to-air gradient, constant load
Hot-spot-to-oil gradient, characteristic load
Oil-to-air gradient, characteristic load
A
Load, Percentage of Rated Kva.
Trip Temperature Setting Deg. C.
Maximum safe loads (Loads that will cause a hottest spot temperature of 105 Deg. C.)
Loads that will cause a hottest spot temperature of 95 Deg. C
Trip temperature setting for an overload indicator to operate when the hottest spot temperature is 95 Deg. C.
B
Jan. Mar. May July Sept. Nov. Jan.
Trip Temperature Setting Deg. C.
Trip temperature setting for an overload indicator to operate when the hottest spot temperature is 95 Deg. C.
Load, Percentage of Rated Kva.
Maximum safe load (Load that will cause a hottest spot temperature of 105 Deg. C.)
Load that will cause a hottest spot temperature of 95 Deg. C
C

FIG. 2—TEMPERATURE GRADIENTS, MAXIMUM SAFE LOADS AND TRIP TEMPERATURE SETTINGS IN REWOUND 5-KVA. CLOSED-COILED TRANSFORMER

A—Template gradients. B—Maximum safe loads and trip temperature settings for characteristic load. C—Same for constant load

and permanence, adaptability or ease of installing and responsiveness to temperature changes.

Tests were conducted with three closed-coil and two open-coil transformers and with nine overload indicators of three different makes. Two of the closed-coil transformers (all of which were of the same make and rated at 2,200/4,400/110/220 volts) were rated at 5 kva. with a secondary current of 22.75 amp. One of these units was rewound to accommodate thermocouples in the winding, and as a result the resistance of the primary winding was approximately 30 per cent higher than that of a stock transformer of the same rating. The other 5-kva. transformer was a stock transformer used to compare its heating with that of the rewound transformer. The third closed-coil transformer, rated at 25 kva., with a secondary current of 113.7 amp., was a stock unit. Both open-coil transformers were of the same make, but different from that of the closed-coil transformer, and were rated at 5 kva., 2,300/4,600/115/230 volts, 21.75 amp. (secondary). One of these units was especially wound by the manufacturer to accommodate thermocouples without increasing the resistance of the winding, and the other was a stock transformer.

In making the temperature test all transformers were operated on two types of load which will later be called "constant load" and "characteristic load." The constant-load heat runs were made with the load held constant until the temperatures of all parts of the transformers had reached their maximum value. This test was employed to simulate the results obtained in power transformers the load on which is practically constant for eight hours to ten hours a day. The characteristic load heat runs were made with the load increasing or decreasing in proportion to the average residential load. The variations made in these loads were determined from the shapes of average residential loads taken over a number of years.

Thermocouples were placed between the primary and inner secondary coils, midway between the top and bottom of the coil and one-third way down from the top of the winding; in the center of the primary winding one-quarter way down from the top of the winding and also one-half way down from the top of the winding; between the inner secondary winding and core midway between the top and the bottom, and in the oil at five points, namely, near an upper corner of the case, near the top midway between the outer coil and the side of the case, above the windings and near the core, near the bottom of the case and at the center of the upper surface.

As the result of the heat run with closed-coil transformers it was found that the hottest spot occurred both in the 5-kva. and in the 25-kva. transformers between the primary and inside secondary winding about one-third of the length of the coil from the top. In both sizes of transformers it was also found that the best practical location for an overload indicator was in the oil directly above the center of the winding and as close thereto as possible.

The thermal gradients differ in transformers of different rating and even in the same transformer, depending on whether the load is varying or constant and on the magnitude of the load with respect to the rating. For example, in the 5-kva. transformer with a char-

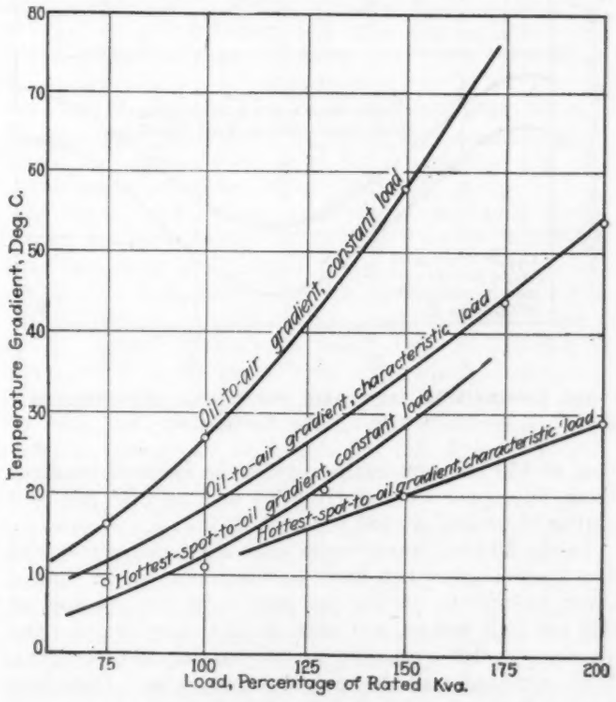

Temperature Gradient, Deg. C.
Oil-to-air gradient, constant load
Oil-to-air gradient, characteristic load
Hottest-spot-to-oil gradient, constant load
Hottest-spot-to-oil gradient, characteristic load
Load, Percentage of Rated Kva.

FIG. 3—TEMPERATURE GRADIENTS IN 25-KVA. CLOSED-COIL TRANSFORMER

acteristic variable load the thermal gradient from hot spot to oil ranged from 20 deg. C. at 100 per cent of rated kva. to 63 deg. C. at 175 per cent of rated kva., while the thermal gradient from oil to air ranged from 20 deg. at 100 per cent to 55 deg. at 175 per cent of rating. In the same-size transformer but with constant load the thermal gradient from hottest spot to oil ranged from 23 deg. at 100 per cent rating to 60

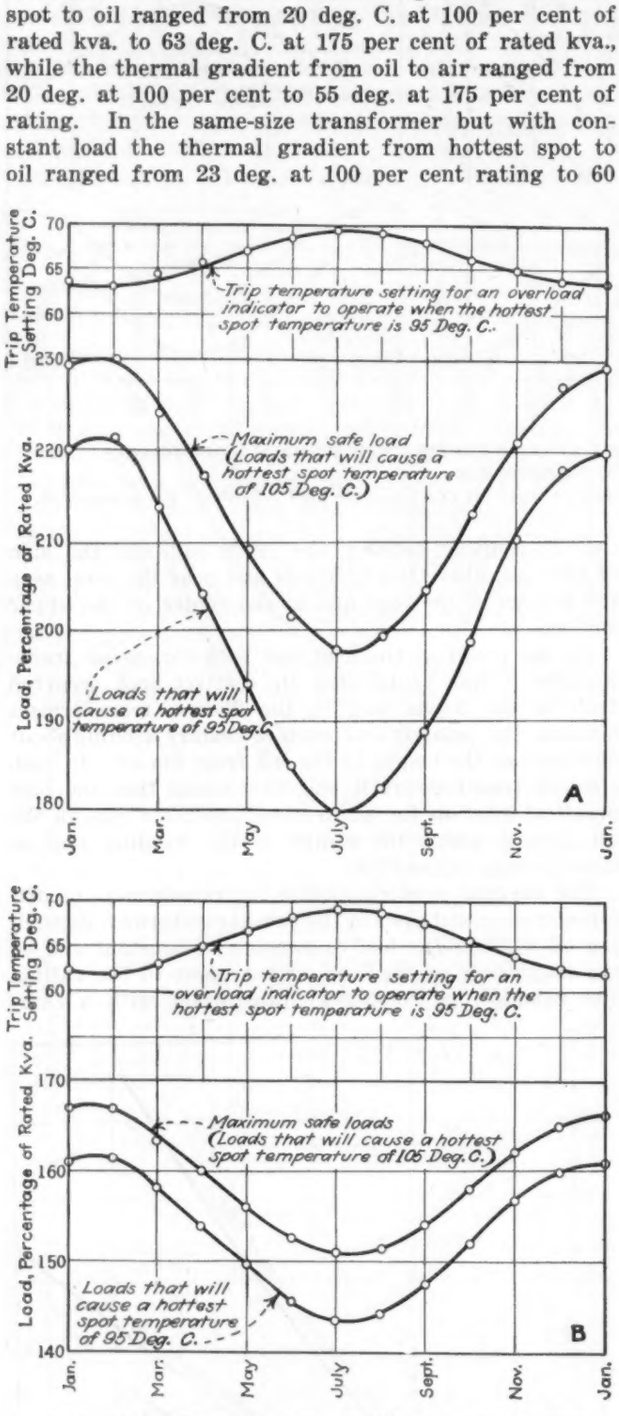


FIG. 4—MAXIMUM SAFE LOADS FOR 25-KVA. TRANSFORMER
A—Characteristic load. B—Constant load.

deg. at 150 per cent rating, while the thermal gradient from oil to air ranged from 26 deg. at 100 per cent rating to 60 deg. at 150 per cent rating.

In the 25-kva. transformer with a characteristic load the thermal gradient from hottest spot to oil ranged from 11 deg. C. at 100 per cent rating to 29 deg. at 200 per cent rating, and that of oil to air ranged from 18 deg. at 100 per cent to 54 deg. at 200 per cent. With constant load the temperature gradient from hottest spot to oil ranged from 7.5 deg. at 75 per cent rating to 29 deg. at 150 per cent rating, and that from oil to air ranged from 18 deg. at 75 per cent to 58 deg. at 150 per cent of rated load.

Based on the maximum temperature which transformer insulation can withstand indefinitely without deterioration and on the ambient temperatures which prevail during summer and winter, it was calculated that the maximum safe loads which the 5-kva. transformer tested will carry in summer and winter are 153 per cent to 176 per cent respectively, while the corresponding figures for the 25-kva. transformers were found to be 198 per cent and 230 per cent respectively.

OPEN-COIL TRANSFORMERS GIVE DIFFERENT RESULTS

The hottest spots under various conditions did not agree so closely in the open-coil transformer as in the closed-coil type. For example, on characteristic variable loads the temperatures were about the same between the primary and secondary windings at points one-half and one-third of the coil length from the top of the coil up to and including 150 per cent of rated kva. However, on 125 per cent and 150 per cent of rated kva. and with different ambient temperatures the one-half point was usually hotter than the one-third point. When the load was increased to 175 per cent of the rated output of the transformer the one-third point had the highest temperature. With constant load and 100 per cent or 125 per cent of rated load at 10 deg. C. ambient temperature, the one-half point had the highest temperature. With the same load at 40 deg. C. ambient temperature the one-third point had the highest temperature. Therefore it was decided that the hottest point would be about midway between the one-third and one-half point, or about 40 per cent of the coil length from the top. However, the thermocouple installed in the oil above the windings and near the coil gave the next highest rating and followed the temperature changes more closely. As in the closed-coil transformer the thermal gradient differs with different percentages of rating under the characteristic and constant load. For example, the gradient from hottest spot to oil at characteristic load ranges from 18 deg. C. at 100 per cent rating to 28 deg. C. at 175 per cent rating, while that from oil to air ranges from 22 deg. at 100 per cent to 57 deg. at 175 per cent. With constant load the hot spot to oil gradient ranged from 17 deg. at 100 per cent to 27.5 deg. at 175 per cent, and that from oil to air ranged from 33 deg. at 100 per cent to 69 deg. at 175 per cent.

Based on these observations, it was decided that this particular make of open-coil 5-kva. transformer could be safely operated at 169 per cent of rating in the summer and 197 per cent of rating in the winter.

One interesting observation in connection with the tests was the time required to establish thermal equilibrium during a constant-load heat run and the time lag in hours between the load peak and the hottest-spot peak, or between the time of maximum hottest-spot and maximum oil temperatures with characteristic varying loads. For example, in the rewound closed-coil 5-kva. transformer it required twelve hours to establish thermal equilibrium when operating at a constant load of 100 per cent of the rated kva. and nine hours when operating at 135 per cent of rated kva. Operating the same transformer with a characteristic varying load, the time lag in hours between the load peak and the hottest-spot peak ranged from one and one-quarter to one and three-quarter hours, and the time lag between the maximum

hottest spot and maximum oil temperature ranged from one-half to one and one-quarter hours. When operating the open-coil 5-kva. transformer rewound by the manufacturer, it required from eleven to twelve hours to establish thermal equilibrium with constant loads of 100 per cent and 125 per cent of rated kva. When this transformer was operated under the characteristic varying load, the time lag between the load peak and the hottest-spot peak ranged from one-half hour to two hours when operated at 100 per cent and 175 per cent of rating respectively, while the lag between the maximum hottest spot and oil temperatures ranged from one-quarter hour to one hour.

Determination of Maximum Safe Loads

The maximum constant and characteristically varying loads that could be carried safely by these transformers were determined as follows:

The ambient temperature during each run was subtracted from the maximum hottest-spot temperature; this gave the maximum temperature rise for that load. For example, in the 100 per cent characteristic load run with a 5-kva. rewound closed-coil transformer the ambient temperature was 21.5 deg. C., which subtracted from the maximum temperature (62.5 deg.) gave a temperature of 41 deg. Subtracting this value from 105 deg. C. (the maximum allowable temperature for transformer installation) gives 64 deg. C., the maximum permissible ambient temperature for this load when the hottest-spot temperature is limited to 105 deg. C. By plotting the maximum ambient temperature at different loads against the percentage of rated kva. it is possible to find the maximum safe load that can be carried with average ambient temperatures existing at the time of the peak load any month of the year, thus giving the data from which a curve may be drawn showing the maximum safe load for each month.

Tests made on one of the transformers during the heat run to determine the effect of ambient temperature on the hottest spot temperature for a given load indicated, as might be expected, that an increase in the ambient temperature would cause almost exactly the same increase in the hottest-spot temperature, showing that the temperature rise for a load of a given character is independent of the ambient temperature.

Insulation resistance tests made during the heat run of another transformer show that an increase in the temperature of the winding to about 60 deg. has a very marked effect in decreasing the insulation resistance. The resistance from primary to secondary and primary to ground in one case was reduced from 17.5 megohms at 60 deg. C. to 6 megohms at 105 deg. C.

The Electrical Industry in France

THE application of electricity has multiplied enormously in France. Factories are making appliances which formerly were bought abroad, and there are 120,000 workers directly employed in the manufacture of all manner of devices. The capital employed exceeds seven billion francs. The industry may be said to have caught up with its loss during the four years of war. The number of exhibitors of French nationality and origin in the electrical section of the recent Paris Exposition was 334, as against 120 in 1920, and the space occupied increased from 1,000 sq.m. to 7,000 sq.m. Among the exhibits was a circuit breaker for a 220,000-volt transmission line.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Power-Factor Correction

To the Editors of the ELECTRICAL WORLD:

The editorial on page 105 of the ELECTRICAL WORLD for July 19, 1924, entitled "Power-Factor Improvement Now a Financial and Commercial Problem," gives the impression that the technical methods now being tried are quite correct and that nothing remains but the commercial problem of inducing owners of apparatus to pay the cost of carrying out these methods.

I should like to point out that methods of power-factor correction are being attempted which are not the best, considered both technically and commercially.

It is a technical matter to realize that if synchronous motors were scattered throughout a city so that the power factor at the generating stations would be unity or slightly leading, then there would be practically no power-factor problem at all. There might be slight disadvantages close to installations consisting of very large numbers of small induction motors, but these would not produce the usual power-factor problem.

The lesson from this is that it is technically and commercially better to correct power factor wholesale than retail. Large motors are being installed all the time, many of them being induction motors. It is more effective to apportion inducements to each individual large motor, so that most large motors installed, of 100 hp. and above, will be of the synchronous type and will be correctly adjusted, than it is to apportion the inducements to each individual customer.

An owner of a few small induction motors should have a technically correct installation from the point of view of power factor, but this will seldom result in a high power factor because load factors are often inherently small. An oppressive power-factor penalty should not be applied to such a small customer, because his unit costs for correcting power factor will be from two to five times as much as for a customer who can install synchronous motors of 100 hp. or more.

In the case of a large customer power-factor penalties or bonuses should be applied to each individual large motor, so as to obtain the synchronous type, and not to the customer's load as a whole. The latter method does not result in synchronous motors being chosen nearly as often as might be. Treating each large motor individually does not require the power factor of each motor to be measured, but requires only the simplest of apparatus and the simplest kind of contract terms, as described by the writer in this magazine (February 9, 1924, page 285).

So long as attempts are made to correct power factor one *customer* at a time, the attempts are mostly on the wrong track. It is necessary to study the question technically from a new viewpoint and adopt methods for obtaining power-factor correction one large *motor* at a time. This has been done with success in the sale of energy to certain large industries, to the writer's knowledge, and it could be done with the same ease and success in city distribution if it only were tried.

Hamilton, Canada. H. B. DWIGHT.

Central Station and Industrial Practice

Machine Shop Integral with Turbine Room

By J. A. Colvin

Superintendent of Generation Minneapolis General Electric Company

Too often the location of a central station machine shop has been relegated to some position where operating conditions are not the best, due to poor light, dirt and inconvenience of handling the larger apparatus. An excellent exception to this is the 87,000-kw. Riverside plant of the Minneapolis General Electric Company. When this plant was developed to its present capacity a machine shop was desired which would be advantageously located, which would be convenient where the larger equipment could be properly handled and where ample light would not delay emergency repairs. This was obtained by placing the machine shop at the end of the turbine room with ample clearances between machine tools to speed up any hurried repairs necessary. Had not this extension in the turbine hall been made, involving a building 75 ft. longer, it is possible that greater expense would have been incurred in locating the machine shop in an outside building. The space below the machine shop was not wasted since a large washroom for the employees was built there, as well as necessary warehouse and storage space.

Future plans for the expansion of the plant were taken care of as the machine shop was located at the south and permanent end of the turbine hall with provision for future expansion to the north.

Railroad tracks enter this south end of the plant so that any repairs on the locomotive cranes can be made under cover by bringing it into the turbine room, instead of allowing it to remain in the open and being hampered by the necessity of moving heavy weights a long distance.

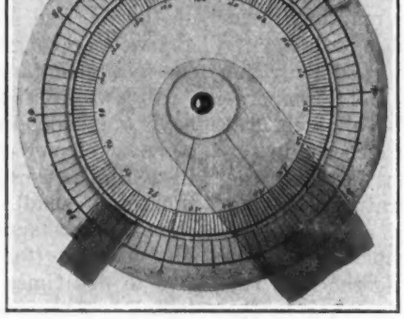
The machine shop is provided with two 18-in. lathes and a 5-ft. radial drill, a No. 2 milling machine, pipe and bolt machine and other incidental machine shop equipment. Thus, these tools, together with the handling facilities offered by the overhead crane, make it possible for all repair work to be handled with ease and in a place where cleanliness and light prevail. The results of placing this shop at the end of the turbine room have more than offset the added expense of building a longer turbine hall, especially in times of stress when very rapid repair work must be done.

Determining Hot Spot Temperatures

By R. L. Frisby

Electrical Engineer of Stations, Kansas City (Mo.) Power & Light Company

Central stations using embedded exploring coils to determine hot spot temperatures in generators are confronted with the problem of a quick determination of actual temperatures where no direct reading instruments are used or where only two or three of the temperature detectors are connected to an indicationg switchboard meter. Usually there are ten or twelve coils installed in each generator and it is advisable to check all coils, especially when running heat tests. Where resistances are read by a Wheatstone bridge considerable time is lost in learning the actual temperature condition by converting a resistance constant to temperature. Some companies have a straight line chart mounted below the instrument, on which is plotted the relation between resistances and temperatures. But this requires interpolation.



HOT-SPOT TEMPERATURE CALCULATOR

The Kansas City Power & Light Company uses a calculator, shown herewith, which gives an instantaneous temperature reading for any resistance value indicated by the instrument. This calculator is formed merely of two circular pasteboards mounted on one center together with a celluloid runner, so that any combination of resistances and temperatures may be obtained. The center circle represents resistance values, while on the outer ring are temperature figures. The index relations between these two circles must be determined by the extreme limits of the Wheatstone bridge reading instrument. Once a straight line relationship has been established between resistances and temperatures the next step is to transfer this chart to polar co-ordinates.

This calculator was calibrated at 10 ohms for a temperature of 25 deg. C. With the inner circle set at this value the celluloid runner is swung to any indicated value of resistance and the actual temperature read off the outer circle. Thus an instantaneous accurate determination of the actual heating conditions in the generator coils can be made. This calculator has been found very valuable in a rapid reading of temperature conditions, especially at times of heavy loads.

Grounding Overcomes Radio Interference

By John M. Drabelle

Chief Engineer Iowa Railway & Light Company, Cedar Rapids, Iowa

A very annoying radio interference problem arose in Boone, Iowa, after the Iowa Railway & Light Company had installed a new 3,500-kw. multiple-stage turbine. Lead-covered, single-conductor cables run direct from the unit to the oil switches, a distance of about 75 ft. Since the interference had not existed before, its origin was thought to lie in the new equipment. It became so distressing that even the newspapers took up the people's cry for relief.

To overcome this interference much time and effort was spent. It was at first thought that the trouble lay with the faulty insulation of the 75-ft. cable, so it was subjected to

a high-voltage test. But this was successfully withstood, showing that no flaws existed in the cable insulation. Then a further analysis with an oscillograph showed what caused the trouble. On the peak of each voltage wave there appeared a small ripple of a higher harmonic. Investigation as to the cause of this higher harmonic then led to the complete solution. Although lead-covered cables were used to transfer energy from the generator to the oil switch, it was found that the lead sheath had not been grounded. Capacity between the cable and the lead created this harmonic, which was dissipated into the air and not to ground as it should have been if proper connections had been made. After grounding the sheath this trouble disappeared entirely.

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Color Code Meter Cables and Test Blocks

SECONDARY wiring from instrument transformers shall be run with color code cable and in conduit. Whenever the current and potential transformers are mounted near together seven-conductor cable shall be used. When there is wide space between the potential and current transformers, four-conductor potential cable and three-conductor current cable shall be used. For three and four-conductor cables ¾-in. conduit shall be used and for seven-conductor either 1-in. or 1¼-in. conduit.

Test Blocks.—Meter test blocks, Figs. 83 and 84, shall be connected ahead of all polyphase meters which are used with current transformers. When steel meter-mounting boxes are used these test blocks are mounted inside the cover. In all other cases the test blocks shall be mounted in small steel boxes which shall be sealed, Fig. 83 for 115 volts and Fig. 84 for higher voltage circuits.

The over-all outside dimensions of the box shown in Fig. 83 are 12¾ in. x 8 5/16 in. x 3 5/16 in. and in Fig. 84 16 in. x 10 in. x 4 in. The 115-volt test block consists of two 2¼-in. x ¼-in. x 9½-in. fiber blocks, while the 230-volt or 460-volt blocks are of two 4¾-in. x ⅜-in. x 12¾-in. fiber blocks.

Handling.—All types of meters and meter transformers, together with any auxiliary apparatus, shall be handled with care. Meters are easily damaged by rough handling and careless packing or transportation because the jewel bearings and clock mechanism are of delicate construction. Meters shall never be placed on the floor of an automobile, train or street car, unless suitably packed or protected by thick, soft padding sufficient to relieve them from both vibration and jarring. So far as possible, watt-hour meters shall be transported only in their original packing boxes, and boxes should be saved for use in transporting other meters removed from service.

Potential and current transformers shall never be carried or handled by their leads, nor shall they be stacked up or thrown about. Damage to the insulation and windings of meter transformers may not only cause loss in value to the transformers, but may greatly increase the likelihood of shock or burn to an employee.

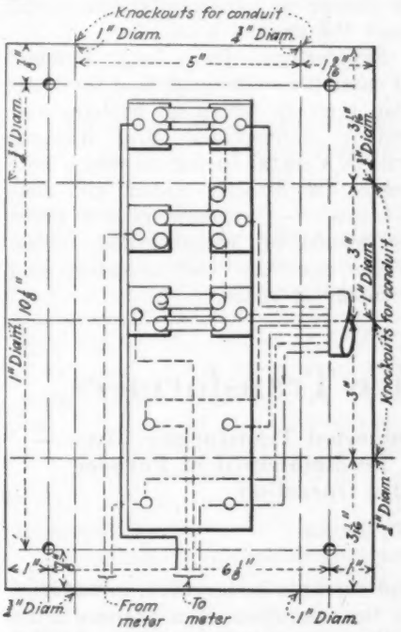


FIG. 83—115-VOLT METER TEST BLOCK

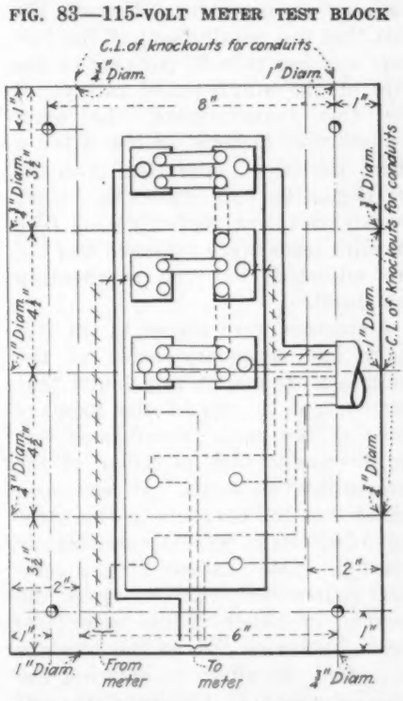


FIG. 84—230-VOLT or 460-VOLT METER TEST BLOCK

British Transmission Practice

BY C. G. WATSON*

Engineering Department Duquesne Light Company, Pittsburgh

IN ENGLAND a great deal of attention, both in the manufacture and in the installation of apparatus, is being paid to detail and highly skilled workmen are being extensively employed. These factors probably account for the relatively small number of failures.

Transmission at 33,000 volts is now standard practice, although one company has a line in operation at 66,000 volts. The majority of transmission lines are underground, but overhead lines are common. Where the latter are in use it is often the case that underground cables connect adjoining sections, and at least one company invariably uses a length of underground cable between the end of an overhead line and the switchboard.

Extensive use is made of balanced current protective systems on lines of 5,000 volts and upward. The system most in use necessitates pilot wires, but an innovation, due to P. V. Hunter, is a four-conductor cable in which two of the conductors are in parallel on one phase, and it is claimed that this arrangement gives full protection at least cost.

Underground Cables.—Cables are almost invariably paper insulated, lead covered and steel armored and laid direct in the ground. In those cases where they are drawn into ducts the tendency is to use a larger section of conductor than would otherwise be necessary, owing to the fact that heat radiation is less when a cable is laid in a duct than when laid direct in the ground. Three-conductor cables are in operation at 66,000 volts.

Operating Temperature of Cables.—This, of course, varies, but care is taken, especially where cables are in operation at the higher pressures, to install sufficient copper so that 65 deg. C. is rarely exceeded.

Insulation Thickness.—In three-conductor, 33,000-volt cables the thickness of insulation around each conductor is 0.25 in. and in three-conductor, 66,000-volt cable the thickness is 0.375 in.

Dielectric Loss and Power Factor.—With insulation thicknesses as above, the dielectric loss and power

*Mr. Watson has recently returned from a visit to England, where he secured first-hand knowledge of operating conditions.

factor in 33,000-volt cables are in the neighborhood of 0.15 watts per foot and 0.7 per cent respectively, while in the only 66,000-volt cable in operation the power factor is similar to that already noted and the loss per foot under three times as much.

Research.—Several of the cable companies spend largely on research, and this no doubt accounts for the reliability of, and even for the possibility of their ability to supply, the higher voltage cables.

Joints.—Details vary according to manufacturers' idiosyncracies, but in general joints are insulated with paper tubes and a semi-liquid compound inclosed in a lead or cast-iron sleeve.

Testing.—Except for short lengths and low voltages, modern practice is to pressure test lines after installation with direct current at three times normal alternating current working pressure for periods which vary from a few up to thirty minutes.

Overhead Lines.—Steel poles are in use, but wooden "A" poles are far more common. Of the steel poles, the "Kay" tubular seems to outnumber the lattice type. Spans vary, but a very usual length is 240 ft. In the case of a 66,000-volt line, it is found cheaper to erect two three-wire lines on wood poles than one six-wire line on steel poles. Connection between overhead and underground lines is made by means of single-conductor, lead-sheathed cables from a pothead near the pole top to a three-conductor pothead either buried in the ground at the foot of the pole or supported some convenient means near the ground level.

Substations.—In a large number of cases the switchgear is of the iron-clad type, in which all busbars and switch connections are inclosed within a metal casing to which potheads are directly bolted, and connections to transformers are made by means of lead-sheathed cables. These practices lead to safety and economy of space.

Unbalance in Furnace Transformers

Theory of Overload on Main T-Connected Transformer Given—Proper Current Relations Must Be Maintained in Furnace Leads for Successful Operation

BY EUGENE C. STARR
Oregon Agricultural College, Corvallis, Ore.

ELECTRIC arc furnaces are now quite generally used in the steel industry because of the better product and the lower over-all production costs. Most of these are of the three-phase direct-arcing type but there are a few which employ a two-phase current on three electrodes because of the blowing effect of the arc onto the metal which is inherent with the arrangement of electrodes shown diagrammatically in Fig. 1. Such furnaces require a two-phase, three-wire, current supply which is generally obtained from T-connected transformers, since few power systems are still being operated two-phase.

Some time ago, a two-phase, three-electrode arc furnace similar to the so-called "Rennerfeldt" type was installed for steel making by a manufacturing concern on the Pacific Coast. Power was supplied from a modified T-connected transformer bank. The two transformers were exactly similar and could not be connected in true "T" because of the absence of an 86.6 per cent tap. The unbalance of secondary voltages and currents is, however, immaterial in the operation of a furnace with such an arrangement. Despite the fact that the requirement of the furnace was less than 85 per cent of the sum of the single-phase ratings of the two transformers, the main transformer became so hot after a short period of operation that the oil began to boil while the other transformer was perfectly cool. The primary leads were reversed and the arc adjusted, but the overheating continued.

Ammeters were placed in the primary and secondary leads of the transformers and it was found that the current in one of the primary leads of the main transformer was almost double that in either of the remaining two leads. It was also found that the currents in the three secondary leads were approximately equal in value instead of the common return carrying 1.41 times the current in either of the other two legs. Reversing two of the primary leads had the effect of shifting the heavy current to the opposite half of the primary of the main transformer winding. When the electrodes were so adjusted that the secondary currents were balanced, or that the current in the common secondary lead was 1.41 times the current in either of the two remaining leads, the primary currents were found to be balanced or equal in all three leads.

RESULTS OF INVESTIGATION

The cause of these difficulties was not apparent until a theoretical investigation was made and the conclusions arrived at checked by experimental data obtained by indicating instruments and the oscillograph. The results show very clearly the causes of the unbalanced primary currents, and the overheating of the main transformer.

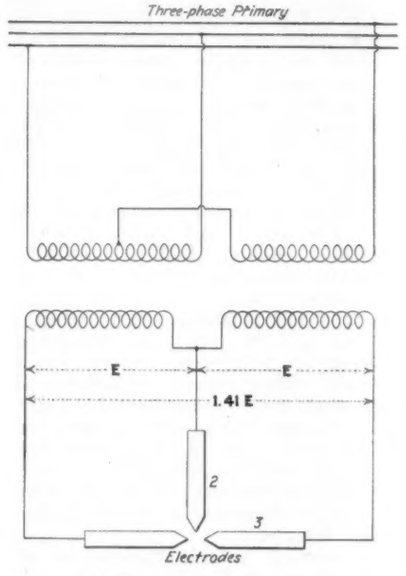


FIG. 1—SCHEMATIC DIAGRAM OF THREE-ELECTRODE ARC FURNACE

For making a laboratory test of the condition, two exactly similar 3-kva. transformers were connected in a modified "T" as shown in Figure 2A, both transformers having 100 per cent of their windings in the circuit, and a two-phase, three-wire load was arranged with water rheostats as shown. The currents in the three secondary leads were held as nearly equal as possible, and readings of the current in each primary and secondary lead were taken for several different loadings. The results of this test are tabulated in the accompanying table. In each case the primary current in one-half of the main transformer was about 50 per cent greater than that in the other half, while the current of the teaser transformer was between the other two in value.

The secondary current was then balanced—that is, the current in the lead common to the two phases was made 1.41 times the current in either of the other two leads, and under this condition the primary currents were approximately balanced; in fact, they were as nearly balanced as would be expected with 100 per cent of the teaser transformer winding in the circuit.

An oscillograph was used to show the phase relationship existing between the primary currents in the three phases with the transformer bank operating in both the balanced and unbalanced conditions. Fig. 3A is an oscillogram of the currents in the three primary phases with the load balanced, and shows the proper 120 deg. relationship existing between all three currents.

Fig. 3B is an oscillogram of the currents in the same three phases with the currents in the three two-phase leads equal, and shows the large inequality of currents in the three phases as well as their distorted phase relationship.

DISTRIBUTION OF CURRENTS IN WINDINGS OF T-CONNECTED TRANSFORMERS

Two-Phase Currents in Secondary Leads			Three-Phase Currents in Primary Leads		
i'_1 Amp.	i'_2 Amp.	i'_3 Amp.	I'_1 Amp.	I'_2 Amp.	I'_3 Amp.
4.00	4.00	4.00	1.50	1.00	1.00
10.20	10.00	10.10	3.60	2.40	2.40
15.20	15.00	15.00	5.40	3.40	3.70
20.20	20.00	20.20	6.90	4.40	5.07
25.00	25.10	25.00	8.40	5.50	6.25
30.00	30.10	29.70	9.95	6.65	7.45
35.30	35.00	35.40	11.80	7.48	8.90
40.00	40.40	40.30	12.40	8.80	10.10

A study of the unbalanced or troublesome condition, without reference to the oscillograms, shows immediately that the secondary currents of the transformer bank are far from a 90 deg. relation. A two-phase three-wire load, having equal currents in its two independent leads and a 90 deg. relation between them will, of course, have a current in its common lead of 1.41 times that in either of the other two leads. Consequently, when, as in the case of the arc furnace in question, the current in all three of the two-phase leads are equal, the phase relation of the currents is far from the ordinary two-phase relation and is represented vectorially in Fig. 2B. Since i'_1, i'_2 and i'_3 are equal they must have the phase relation shown in the diagram. A vector diagram of primary currents may now be constructed upon this foundation by using the phase displacement angles obtained from the oscillogram in Fig. 3B. If the primary currents were balanced, they could be represented vectorially by I_1, I_2 and I_3 in Fig. 2C. In this condition the currents are of equal value, and have a symmetrical phase displacement of 120 deg. Using I_1 as the reference vector, and applying the phase angles obtained from Fig. 3B, I'_2 and I'_3 may be placed in their true positions. I'_3 is a direct function of i'_3 the secondary current of the teaser transformer, and may be assumed to have any convenient value such as 4.75 amp., the value of I'_3 in Fig. 3B corresponding to about 70 per cent of the full load current rating of the transformers. Now that the value of I'_3 is known, and also the phase angles of I'_1 and I'_2, the corresponding values of these remaining currents may be readily calculated.

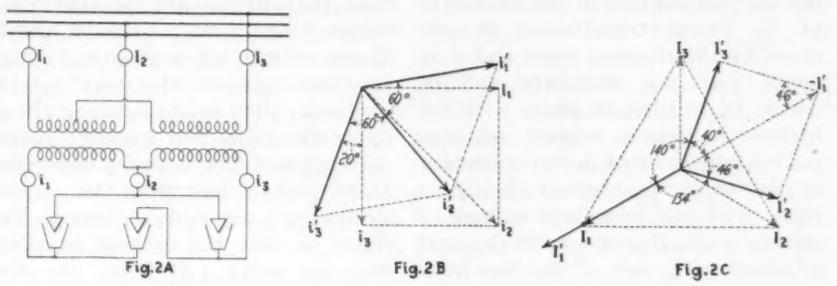


FIG. 2—CONNECTIONS FOR STUDYING UNBALANCED CURRENTS IN FURNACE TRANSFORMERS WITH VECTOR ANALYSES

The calculated value of I'_1 from the vector diagram in Fig. 2C checks within 1.5 per cent of the experimental value, and the calculated value of I'_3 checks within 0.24 per cent of the experimental value. Considering that only approximate methods were used in measuring the angular displacement of the current waves in Fig. 3B, it is seen that these checks are reasonably accurate.

In order to show that, as long as the secondary currents remain equal, the distorted phase angles of the primary currents do not change very materially with change in load, a value of I'_3 was chosen from the table and carried through another set of calculations, employing the same phase angles as before, to determine the calculated values of I'_1 and I'_2 for a check against the experimental values of these currents. For this case the value of I'_3 of 7.45 amp., which is about 110 per cent of the rated full load current of the transformers, was used. In this case there is a slightly greater discrepancy between the experimental and calculated values of I'_1 and I'_2 than there was in the former case, but this error is not great enough to be due to any material change in the phase angles, and is probably due, in part, to the slight inequality of secondary currents existing in this case.

A study of the experimental data in the accompanying table in connection with the vector diagram in Fig. 2C shows that for very light loads I'_3 lags its true position by the same angle that I'_3 leads its true position. As the load increases, I'_3 increases its lag by a small angle, and I'_3 decreases its lead by about the same angle. This slight change in phase angles is due to the unbalanced secondary voltages caused by the absence of an 86.6 per cent connection on the primary of the teaser transformer, and also to the unequal impedance drops in the two halves of the main transformer. In this connection it may be interesting to note that when balanced two-phase currents, without regard to voltages, are drawn from the secondary of a bank of T-connected transformers, these transformers being exactly similar and having 100 per cent of

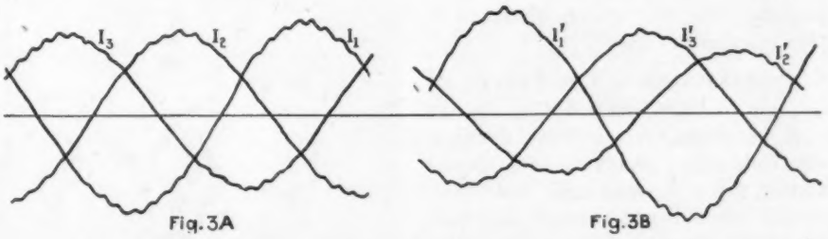


FIG. 3—OSCILLOGRAM SHOWING BALANCED AND UNBALANCED CONDITIONS

their windings in the circuit, the three-phase primary currents are not balanced, but are greater in the two halves of the main transformer than in the teaser transformer. The cause of this apparent discrepancy is that the ratios of the two transformers are the same, and hence, in the case of a unity power factor load, the current induced in the secondary of the teaser transformer is governed by the common ratio and is in phase with the secondary voltage, which, is, in turn, in phase with the primary voltage to neutral; whereas the current induced in the secondary of the main transformer, being in phase with the secondary voltage of the main transformer, is 30 deg. out of phase with each of the two voltages to neutral in the primary of this transformer, and hence can have a value only 86.6 per cent as great as the value of the current in each of the two halves of the primary of the main transformer.

RESULTS OF EXPERIMENTAL AND THEORETICAL INVESTIGATION

The results, both experimental and theoretical, of the investigation which is outlined in this article, indicate that with a condition of this kind, as long as the three two-phase currents remain equal, the current in one-half of the primary of the main transformer will be approximately 50 per cent greater than that in the other half. It is obvious, however, from a study of the vector diagrams in Figs. 3A and B that if the current, i'_2, in the common lead of the two-phase secondary were to be made slightly smaller in value than that in either of the other two leads, the currents from the supply mains. current, I'_2, in one-half of the primary of the main transformer would quickly rise to a value twice as great as either of the other two primary currents. This latter condition is probably the one which obtained in this particular case.

CHARACTERISTICS OF THREE-ELECTRODE ARC

It is characteristic that a three-electrode arc receiving its power supply from a two-phase three-wire circuit should not, unless carefully adjusted, draw balanced two-phase currents from the supply mains. Fig. 1 illustrates an arc of this type, and shows that the voltage between electrodes 1 and 3 is 1.41 times the voltage between electrodes 1 and 2 or between electrodes 2 and 3. It is a well-established fact that the voltage drop in an arc has by far its greatest magnitude near the surfaces of the electrodes. The drop in the arc stream is small in comparison with the contact drop at the electrodes. From these considerations it is readily seen that although the arcing distance is greater, the ohmic resistance of an arc between electrodes 1 and 3 is only slightly greater than that of an arc between electrodes 1 and 2 or between 2 and 3. Hence with a much greater voltage existing between the two outside electrodes than exists between either electrodes 1 and 2 or 2 and 3 greater currents will flow between electrodes 1 and 3 than flow from the outside electrodes to the middle element. The result is that the central electrode does not carry 1.41 times the current carried by either of the other two electrodes, as it must in order that the arc may draw balanced two-phase currents from the supply lines, but may even carry less current than do either of the other two elements. This type of arc, in order to function properly, must offer no direct path for an arc stream from electrode 1 to elctrode 3.

The experimental data used in this article were taken in the electrical engineering laboratory at Oregon State College.

Tailwater Gage Indicates Range of Elevations

AN EFFECTIVE indicating gage showing tailwater elevations in both feet and tenths is in use at the Cabot station of the Turners Falls (Mass.) Power & Electric Company. As shown in Fig 1, the gage consists of a dial 30 in. in diameter divided into ten graduations and provided with a long hand, indicating tenths of a foot, and a short hand, indicating feet. The former is carried on a shaft extension from a drum 8 in. long by 4 in. in diameter at the rear of the dial and the drum is rotated through one revolution for each foot of variation in the height of the tailwater. A float in the tailrace is connected with the drum by $\frac{1}{8}$-in. wire rope and the drum is counterweighted.

FIG. 1—FLOAT-CONTROLLED GAGE READS IN FEET AND TENTHS

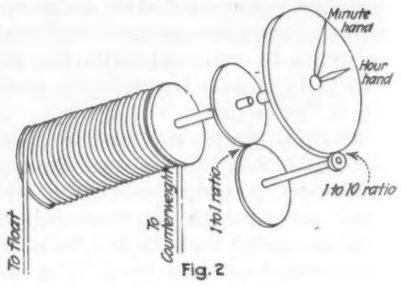


Fig. 2

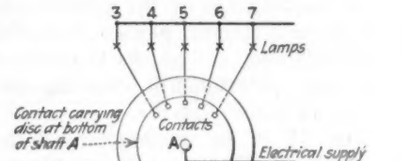


Fig. 3

FIGS. 2 AND 3—SCHEME OF GEAR REDUCTION AND LAMP CONNECTIONS

The short hand is geared from the drum, as indicated in Fig. 2, to make one rotation for every ten revolutions of the drum, and the two hands are mounted so that each turns about the center of the dial without affecting the other. In this way the short hand makes one revolution for every 10 ft. of change in elevation, and at each complete revolution of the short hand a small flexible stop near its outer end moves a toothed wheel contact disk one notch behind the dial, thus lighting an incandescent lamp behind the transparency shown at the top of the dial panel. This gives a luminous indication of the tailwater height in steps of 10 ft. each.

The height of tailwater at the time the photograph was taken can be seen to register 41.5 ft. above a predetermined base. The moving shafts of the gearing work in ball bearings and the contact on the short hand, whose electrical connections are shown in Fig. 3, restores each lamp in circuit as the tailwater rises or falls. The gage was designed by L. A. Fitts, assistant superintendent of power, Turners Falls company.

Central Station Business

Rural-Line Experiments Bringing Information

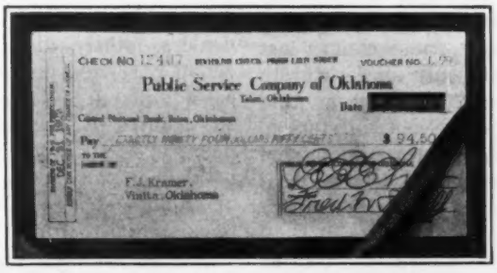
EXPERIENCE in developing farm loads is already being obtained on the experimental farm line in Wisconsin, one of a number of state co-operative efforts which have been inaugurated under the auspices of the Committee on the Relation of Electricity to Agriculture. As explained in previous issues of the ELECTRICAL WORLD, the purpose is to ascertain whether farm loads can be developed to the point where it will be economical for utilities to serve them and for farmers to purchase the energy. The experiment is being conducted under the immediate direction of the Wisconsin Committee on the Relation of Electricity to Agriculture and has the attention of Professor Duffee of the Wisconsin College of Agriculture, and E. R. Meacham, who holds an agricultural engineering fellowship supported by the Wisconsin Utilities Association.

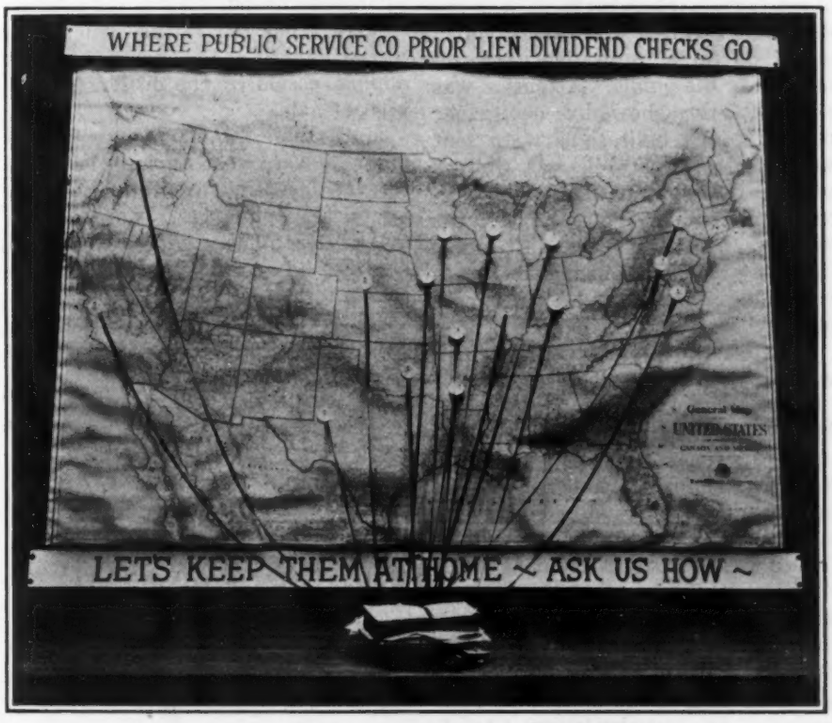
On one farm it has been found that the inconvenience of starting a gasoline-engine-driven pump for supplying running water to the house and barn will be overcome when an electric motor is substituted for the engine and an automatic switch installed to start the pump whenever the pressure in the system falls below a predetermined limit. One farmer who has raised a great deal of poultry by using an oil-heated incubator and brooder and will probably replace them with an electric outfit. Another farmer with a growing family has found that many of the tasks that were quite difficult with only small boys for helpers are made much easier when a motor is available.

From experiment with an electric hay hoist it has been shown that not only can a boy operate such a hoist but it is possible therewith to interchange the hayrack and pea rack on the wagon without taking the racks apart as was necessary before the electric equipment was installed. A farmer who has just abandoned his individual electric plant and connected with the power line is driving his milking machine, which was formerly operated directly from the gas engine which also drove the electric generator, by means of a 2-hp. motor. Still another farmer has decided to put in an electric refrigerator as his first convenience in addition to the lights. Two pea-vining stations are also receiving service from this line. One has a 20-hp. adjustable-speed motor operating two viners, while the other has a 20-hp. constant-speed motor, speed adjustment being secured through a Reeves controller.

Attracting Attention to Utility Securities

NO ONE part of any practice can usually be classed as the most important factor, but it is the combination of the little things that often makes the composite successful. Just one idea that has helped to attract the attention of customers of the Public Service Company of Oklahoma to the advantages of owning utility securities has been the display of a large fac-simile dividend check with a continually changing date. Attention is called in prominent manner to the fact that purchasers of the company's securities will receive a dividend check at periodic intervals indicated by the changing date. The date-changing mechanism is driven by a motor. The colossal check is mounted in a prominent place in the company's new office at Tulsa, where persons coming to pay their bills cannot fail to see it. Advantage is also taken of this display to attract attention to the security salesman, whose desk is placed

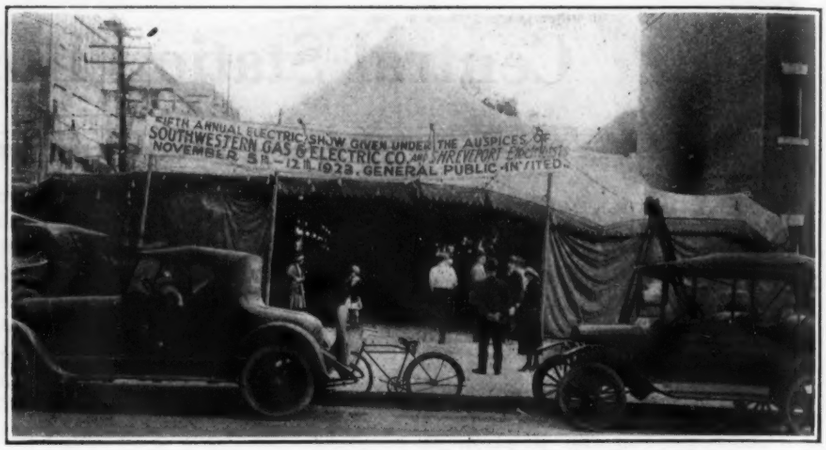




LARGE FAC-SIMILE OF DIVIDEND CHECK AND MAP SHOWING DISTRIBUTION OF STOCKHOLDERS

in the open office in front of the colossal check. This position has been found much more effective than back of a railing or in some remote place.

Another display which has attracted the attention of customers is a map of the United States with ribbons leading from different cities to bundles of dividend checks. It is pointed out that dividend checks are mailed to holders of the company's securities all over the United States to indicate that they are held in high regard. The size of the bundles of checks are made proportionate to the number sent to each district.


FIFTH ANNUAL ELECTRIC SHOW GIVEN UNDER THE AUSPICES OF
SOUTHWESTERN GAS & ELECTRIC CO. AND SHREVEPORT EXCHANGE
NOVEMBER 8 TO 12 INCL. 1923. GENERAL PUBLIC INVITED

EXTERIOR VIEW OF TENT ELECTRIC SHOW

Electric Show Under Tent Draws Business

By R. E. Naylor

New-Business Manager Southwestern Gas & Electric Company, Shreveport, La.

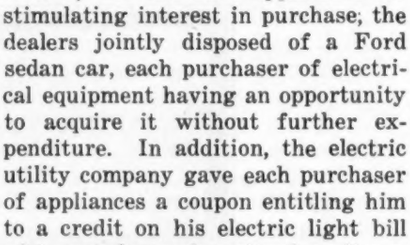
TO CAPITALIZE on the attraction which entertainment under a tent usually has for the public, the Southwestern Gas & Electric Company, Shreveport, La., conducted a joint electric show under canvas last fall. It was not only successful in selling electrical appliances and building load for the central station, but very effective in acquainting the public more intimately with the local electrical dealers and the utility company.

As the show was held in a city of about 50,000 inhabitants, it was not difficult to find a vacant lot which would be fairly convenient and accessible to the public. Attention was called to the show by newspaper publicity, and invitations were sent with electric light bills, as well as being extended by notices in the electric light company's offices and in the windows of the dealers. At night the tent was made conspicuous by exterior illumination and by glimpses of activities going on within.

All electrical dealers in Shreveport were represented in this joint electric show, each one having a booth inside the tent for the display of appliances. The Southwestern Gas & Electric Company, which does not merchandise, also had a booth, the most popular one of all, since it served as a central distributing point for automobile chances and electrical energy coupons. By fostering this co-operative method of stimulating electrical business and by other efforts to help electrical dealers collectively, the Southwestern Gas & Electric Company has developed a very friendly attitude among the various electrical interests of Shreveport. Display space is allotted to the electrical retailers in the company's windows, the dealers following each other in turn for periods of two weeks each.

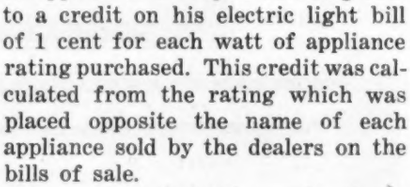
Instead of relying entirely on the convenience and comforts made possible by the electrical appliances for stimulating interest in purchase, the dealers jointly disposed of a Ford sedan car, each purchaser of electrical equipment having an opportunity to acquire it without further expenditure. In addition, the electric utility company gave each purchaser of appliances a coupon entitling him to a credit on his electric light bill of 1 cent for each watt of appliance rating purchased. This credit was calculated from the rating which was placed opposite the name of each appliance sold by the dealers on the bills of sale.

More than $40,000 worth of appliances were sold during the show so every evening three minor prizes, electrical appliances, were given away. Enough appliances were sold during the one-week tent show to earn a total credit of $15,000 on electric bills. Furthermore, the domestic consumption jumped about 4 to 5 per cent after the show, indicating that the appliances were being used on the Southwestern Gas & Electric Light Company's system and not purchased chiefly as gifts for friends out of town.


SOUTHWESTERN GAS & ELECTRIC COMPANY
SHREVEPORT, LOUISIANA

GOOD FOR
25c
In Payment of Electric Bills in Accordance With Rules on Reverse Side.

No. 7540 2


This Coupon will be honored only when presented by the party to whom it was originally issued in payment of bills for electricity used at the point of installation of the appliance, with the sale of which this Coupon is issued. Coupons will be accepted only in multiples of 25c and no change will be made.

Coupons will be honored only if presented before November 20th, 1924.

FORM OF COUPONS GOOD FOR REBATE ON LIGHT BILLS

Employee Contest for Lowering Accidents

ALTHOUGH the Northern States Power Company operates under the workmen's compensation act, it feels that it has a further responsibility to its employees and for that reason has organized a continuous prize contest to stimulate active interest in better safety methods.

The contest covers a period of one year and the scoring of points is held quarterly. A prize trophy will be given at the end of the first period to the division then holding the highest score, but it will have to maintain that record for the year to hold the trophy permanently. The contest is based upon the individual accident record of each employee and the collective results of all accident records in each division. This prize contest, besides bringing about a friendly rivalry between divisions, aims to promote a full working no-accident time record for each employee on the basis of three months or seventy-five working days. Each employee is urged to strive for 100 per cent no-accident record and 100 per cent full working time.

Under a demerit system each division is charged with certain points for each employee having an accident, as shown on the score card reproduced here. Employees at fault for accidents to other workers will be charged the demerits, while the

SCORE CARD SHOWING DEMERITS FOR VARIOUS ACCIDENTS

No.	Class of Accident	Days Lost	Demerits	Score
	A—Minor—No lost time—No fault		2	
	Minor—No lost time—At fault		5	
	B—Minor—Loss of time—No fault—per day		2	
	Minor—Loss of time—At fault—per day		5	
	C—Serious—Temporary disability—No fault—per day		2	
	Serious—Temporary disability—At fault—per day		5	
	D—Serious—Permanent disability—No fault		50	
	Serious—Permanent disability—At fault		100	
	E—Fatal—No fault		50	
	Fatal—At fault		100	
	F—At Fault—Accidents to others:			
	1. Minor—No lost time		25	
	2. Minor—Loss of time		50	
	3. Serious—Temporary disability		75	
	4. Serious—Permanent disability—Fatal		100	

employee injured will not receive demerits unless he is partly to blame, in which case both of the men will be demerited.

Division rating is determined by allowing 100 points for each employee, which multiplied by the average total number of employees on the division payroll during each quarter gives the total number of merit points credited to that division. The total number of demerits charged from accidents will then be deducted from the total division's merit points. The remainder divided by the total divisional merit points will give the percentage rating of the division.

The definitions of the disability terms used declare that an employee is at fault if the safety committee finds him guilty of negligence or carelessness, while a serious accident will be considered one which results in a loss of seven or more working days from which the employee will ultimately make complete recovery and return to his duty.

The idea back of the no-accident contest is primarily to impress upon employees a wholesome respect for the safety movement by showing them that any decrease in accidents means increased efficiency and better pay and that the standing of their own division rests upon their individual working records.

Michigan Utilities Plan "Open-House Week"

RECOGNIZING that the average man and woman look upon the public utility business as something of a mystery, the public utilities of Michigan will conduct an "open-house week" beginning October 6. Its purpose will be twofold—first, to emphasize the achievement of the utilities in keeping pace with the growth of the state and supplying a high standard of service as demanded; second, to make it clear what a complicated business structure is necessary to render this public service. These objectives are to be accomplished by arranging for public inspection of the utilities' properties, by displays of posters, equipment, models, charts and maps and by public meetings addressed by speakers supplemented by motion pictures showing company operations wherever possible.

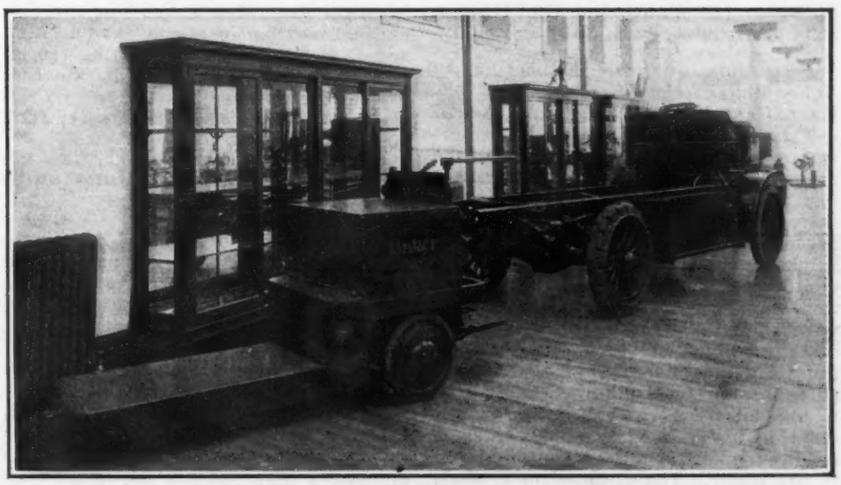
The Public Utility Information Bureau of Michigan, which has laid plans for the open-house week, has sent an outline of its plan to each company, recommending what to exhibit, ways to organize and methods of gaining publicity and telling how the bureau will help. The bureau is also serving as a clearing house for any original ideas which can be used by all companies. It is planned to combine this program with the national "better home-lighting" movement this fall to give the general public a panoramic view of the organization and range of activities of the public utility companies.

The Information Bureau of Michigan is co-operating to the utmost with every company in this effort. Preparation of special announcements, outlining of interviews, preparation of posters showing company progress, state and national statistical data, provision of outside speakers and motion pictures on subjects relating to the utilities and assistance in preparing exhibits are all within the scope of the bureau's normal functions. Alfred Fischer is directing the work for the information bureau in conjunction with the open-house week.

Electric Trucks Displayed at Heavy Traffic Center

TAKING advantage of the location of a new showroom at the mouth of the vehicular tunnel now being constructed under the Hudson River to connect New York City with New Jersey, the New York Edison Company has set aside a portion of its window space for a permanent display of electric trucks, charging boards and batteries. The display consists of three street trucks and two industrial trucks, together with charging and battery exhibits. Interesting charts showing the economy of the electric truck are a part of the display. It is planned to rotate the various makes of vehicles displayed so that all manufacturers will be represented equally.

While the exhibit has only been recently opened, the automobile bureau of the New York Edison Company reports that a number of truck users have already come into the showroom to make inquiries and the results are very satisfactory and encouraging.



VIEW OF NEW YORK EDISON COMPANY'S PERMANENT ELECTRIC TRUCK DISPLAY

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

The Great Lake Hydro-Electric Scheme in Tasmania.—The year 1923 marks a page in the history of the hydro-electric department of the State of Tasmania, when the Great Lake hydro-electric project was officially opened. The State of Tasmania is one of the few countries in which a comprehensive survey of water resources has been made. Even here, however, the survey is not complete, but data are available showing that sources of power aggregating about 400,000 hp. have been located beyond those which have now been developed, while estimates run to an additional 130,000 hp. from sites less definitely investigated. Approximately 70,000 hp. has been developed. The Great Lakes region is in the very center of the island and consists of an area of approximately 153 square miles. The annual rainfall at the southern end of the lake is approximately 30 in., while at the northern end it is about 60 in. Water released from the Great Lake flows for a distance of 4 miles down to the River Shannon and is then diverted by a weir into a canal 3½ miles in length and into a natural lagoon. Between this lagoon and the site of the power station at Waddamana, situated on the bank of the River Ouse, there is a difference of elevation of 1,120 ft., and the entire drop is utilized by carrying the water in a series of wood and steel pipes from the lagoon to the power station. An extremely detailed account is given of the Waddamana power house, of the new dam which serves to impound the water in the Great Lake itself, and of the flumes, penstocks, turbines, switch galleries, transmission lines and substations. The article is twenty-two pages long and contains sixty-five line drawings, and nineteen halftones.—*Engineering* (*England*), Vol. CXVII, Nos. 3038, 3041, 3044, 3045, 3048 and 3051.

Prevention of Scale Formation by Boiler-Water Conditioning. — R. E. HALL, CARL FISCHER and G. W. SMITH. —There are three phases to boiler-water conditioning—namely, (a) the prevention of scale formation by making the solid material precipitating therefrom calcium carbonate and preventing any deposition of calcium sulphate, (b) the separation of the precipitated sludges, and (c) the separation of moisture from the steam. Apparatus suitable for boiler-room use is describes which enables the boiler operator to determine easily the necessary sulphate and carbonate concentration in his boiler water. The authors point out that analysis of the feed water is needless unless acidity be encountered in the water. The mechanism of scale formation is indicated. Whether materials form adherent scales or sludges is determined by their change of solubility with temperature change. The carbonate concentrations which are necessary in the boiler water to inhibit the deposition of hard adherent scale when the sulphate concentration varies are presented in a series of curves suitable for boiler-room use. The rapid development of caustic soda from soda ash at boiler temperature is discussed and the possible error in using caustic soda is pointed out. A specific example is discussed relative to the merits of different methods of sludge removal. The causes of wet steam are discussed and methods recommended for its control.—*Iron and Steel Engineer*, June, 1924.

Generation, Control, Switching and Protection

Power-Plant Unit Costs and Their Engineering Significance.—LINN HELANDER.—Data on plant construction show that with capacities from 20,000 kw. to 60,000 kw. the cost per kilowatt-hour is about $125 when the space available within the building is fully utilized and no spare turbo-generator capacity is provided. Boiler room costs about $300 per boiler-horsepower installed, though this cost varies widely according to conditions. Tables accompanying the article give the cost of steam turbines and generating stations, apportioned equipment and construction costs of boiler plants and an analysis of commercial operating economies of a 10,000-kw, turbo-generator operating at three different points of vacuum.—*Electric Journal*, June, 1924.

Explosion Pots.—C. C. GARRARD.—Explosion pots or chambers surrounding the fixed contacts of an oil switch with a view of increasing the breaking capacity are now used by several manufacturers. In operating, the gas pressure generated inside the chamber expels moving contacts at a high speed, at the same time forcing the oil into the arc and quenching it. Several typical designs are illustrated and described.— *Electrician* (*England*), June 20, 1924.

Transmission, Substations and Distribution

Calculation of Steel-Aluminum Cables.—O. STRAND.—Formulas and simple graphs are given for calculating the distribution of mechanical tension between the aluminum and the steel component of bimetallic cables for various temperatures and various initial tensions. It is shown that initial tension improves the elastic limit of such cables but does not increase the rupturing strength. Damaging of the aluminum wires affects the latter considerably. Under certain conditions small defects in the aluminum may cause considerable decrease in the rupturing strength of the cable. Relative motion between the two metals has never been observed to be a cause of expansion or contraction. The investigations have established the fact that the strength of the steel in a steel-aluminum cable is much better utilized than is usually assumed. It has also been shown that, contrary to previous assumptions, the strength of such a cable does not depend to any great extent upon the temperature.—*Elektrotechnische Zeitschrift*, June 19, 1924.

Steel-Armored Cables for Alternating Current. — H. SVENSON. — This paper gives the results of a series of tests made by the Sievert Cable Company of Sunyberg, Sweden, as well as an analytical discussion of the problem. The losses in cables enforced by a solid steel covering are considerable, but can be reduced to tolerable values by cutting a narrow longitudinal slot in the covering or by a covering of two or more segments. Cables reinforced by steel wires of round cross-section give much smaller losses. The results indicate that this kind of cable can be used as a three-phase cable with separate neutral wire. By inserting one or two non-ferrous wires in the armoring it is possible to apply the cable for one phase and separate return wire.—*Teknisk Tidskrift* (*Sweden*), *Elektroteknik*, July 5, 1924.

Units, Measurements and Instruments

Dielectric Hysteresis Loss in Fibrous Insulating Materials.—Y. TORIYAMA.—The fibers in dried fibrous insulating materials are not so complete an insulator that adjacent fibers may not be considered as forming a small leaky condenser. Consequently there will be a dielectric loss due to the discharge through the leakage path of the condenser when the fiber insulating material is subject to alternating current. By this consideration the residual charge and the dielectric hysteresis loss in the insulating materials can be defined.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1924.

Instrument for Testing Current Transformers.—R. S. J. SPILSBURY.—The author describes an instrument which forms a suitable detector for the Silsbee comparison method of testing current transformers. A short account of the theory and limitations of the method is first given, followed by a description of the special instrument with an analysis of its errors. The paper concludes with some notes on the auxiliary apparatus required for the method.—*Journal of Scientific Instruments* (*England*), June, 1924.

Water Measurement and Its Relation to the Testing of Hydro-Electric Plants.—F. JOHNSTONE TAYLOR.—The efficiency fo a hydro-electric plant is obviously the relation between the shaft horsepower and the calculated water power available in the water discharged from the turbine, a quantity not always readily determined. So far as the shaft horsepower of the turbine is con-

cerned, it can be readily determined by measuring the electrical output if suitable allowances are made for losses. The available horsepower is obtained by the process of resolving the quantity of water passing into pounds per minute, multiplying by the working head and dividing by 33,000. The point, however, which gives rise to difficulty is the estimate with tolerable accuracy of the quantity passing, while the exact working head also will, in the case of large low-head turbines especially, have to be ascertained with accuracy. Suitable methods for determining these various quantities are outlined by the author.—*Electrical Times (England)*, July 3, 1924.

Illumination

Equipment and Operation of a Typical Lighting Plant.—H. R. LORD.—The author proposes a method of supplying a town of from three thousand to six thousand inhabitants. On the basis of 1 kw. per twenty inhabitants, 300 kw. is the total capacity of the plant. Crude-oil engines of 450 hp. and 80 hp. respectively with a speed of 500 r.p.m. are chosen as the prime movers. Alternating current is generated at 2,200 volts, 50 cycles, three-phase, and transmitted to a central substation, where it is stepped down to 240-415 volts and distributed through four subcircuits. Annual charges, which include operation and maintenance of plant, amount to approximately $40,000, while the revenue from all sources is estimated at approximately $45,000.—*Electrical Engineer of Australia and New Zealand*, May, 1924.

Motors and Control

Synchronizing an Induction-Type Synchronous Motor.—Y. WATANABE.—The motion of the rotor of an induction motor during its synchronizing period with direct-current excitation may be expressed by a differential equation of the second order. This equation cannot be solved by the usual mathematical method, but lends itself to graphical solutions. Two graphical methods are explained, one being the differential method, and the other the integral method. The author explains the manner in which the synchronization is effected and determines the relation between the limiting slip for synchronization and the magnitude of the direct-current magnetization.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1924.

Synchronous Motor Drives in Ice and Refrigerating Plants.—TRUMAN HIBBARD.—Of late there has been a notable advance in the application of synchronous motors to the various types of equipment used in the manufacture of ice and refrigeration. After reviewing old practices of driving this type of equipment, the author considers the present practices, the comparison of small direct-connected motors with small induction motor, effects of current variation on the motor, mechanical balance of compressors, application of motors to existing engine-driven compressors, motor voltage, efficiency and power factor, comparison and characteristics of typical synchronous motors and the various types of starting equipment now in use.—*Paper presented at the Fourth International Congress of Refrigeration*, London, June 16-24, 1924.

Electrophysics, Electrochemistry and Batteries

Non-Arcing Metals.—H. OYAMA.—The author has observed with special care the long arcs of copper, zinc and brass. Copper arcs are stable, but zinc arcs become unstable at a larger length. The character of the brass arc gradually changes from that of zinc to that of copper. The author concludes that when long arcs are lit between metal electrodes, the case of oxidation of the metal vapor in the arc steam is a paramount factor governing the non-arcing quality of the metal.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1924.

Bibliographies for X-Rays and Metals.—The bibliographies given cover the subjects of X-rays, metals, space lattice, atoms, solid solutions, etc., and were prepared by Prof. O. E. Harder of the department of metallography of the University of Minnesota.—*General Electric Review*, June, 1924.

Heat Applications and Material Handling

Mercury Vapor as an Industrial Heating Medium.—CROSBY FIELD.—In many processes where heating is a necessary operation the temperature required precludes the use of steam as a heating medium. This has caused the engineer to turn to direct firing for his heat, and in many cases he is thus prevented from maintaining close control of his process. The author presents an alternative method for heating operations where steam will not serve. The mercury-vapor system he advocates allows a control at least as close as that obtained with steam. Its application will be of undqubted service to many industries.—*Chemical and Metallurgical Engineering*, June 23, 1924.

Operating Costs and Industrial Electric Heating.—W. S. SCOTT.—During the last five years there has been sold industrial electric heating apparatus of all kinds rated at over a million kilowatts, exclusive of the equipment sold for the heating of street cars. It is estimated that there is now in daily operation 1,250,000 kw. of heating apparatus. During the last three years there has been a growing tendency to utilize electric heating equipment in the maintenance department of shops and plants. The processes in these departments are very similar to those in the manufacture of finished products, and heating apparatus can be supplied in capacities suitable for this work. Considerable study has been given to the needs of such shops, and steps have been taken to apply standard apparatus or modifications thereof, or to design new equipment to meet their needs.—*Electric Journal*, June, 1924.

Telegraphy, Telephony, Radio and Signals

Cape Cod Marine System of Radio Corporation of America.—F. H. KROGER.—This paper gives a general outline of the character of traffic handling which is required in a modern marine radio-telegraph communication system. A description of the Cape Cod multiplex marine station of the Radio Corporation of America is given, and the operating problems encountered in supplementing spark transmitting sets with vacuum-tube transmitters are outlined. A brief description, with photographs, of the transmitting and receiving equipment is given, and the advantages made possible by the application of modern radio engineering methods to marine coastal stations are explained.—*Proceedings of the Institute of Radio Engineers*, June, 1924.

Quantitative Study of Regeneration by Inductive Feed Back.—C. B. JELLIFFE and J. A. RODMAN.—An inductive coupling between the tuned grid circuit and plate circuit of a radio-receiving circuit network employing an electron tube has been extensively used for the amplification of received signals since its discovery by E. H. Armstrong. Using simple alternating-current theory, this paper shows that the amplification produced by this type of regeneration in an amplifying circuit network can be considered as being caused by a reduction in the resistance of the tuned circuit.—*Scientific Paper No. 487 of the Bureau of Standards.*

Traction

Railway Superpower.—F. L. BUTLER.—The method by which the Georgia Railway & Power Company systemmatically operates its hydro-electric plants and participates in the superpower development of the Southeastern section of the United States is outlined. The developments at Tallulah Falls and on the Tugaloo River in Georgia are described.—*Electric Traction*, June, 1924.

Operating Problems Under Electric Motive Power.—In the event of the electrification of a portion of an existing operated railroad, it is to be expected that certain changes in operating methods and practices will be necessary. Such enforced changes are discussed in this article. Methods and practices in the handling of long freight trains under electric operation on heavy grades are particularly treated.—*Railway Review*, June 21, 1924.

Miscellaneous

Oil Storage and Handling Practice.—Proper storage of the various oils used by electric railways is of vital importance on account of the fire hazard involved. In order to ascertain current practice a survey was conducted covering the storage, handling and reclamation of lubricants as well as the storage of gasoline, turpentine, alcohol and paint oils. Careful storage of lubricants eliminates waste, prevents contamination, minimizes fire hazards and facilitates keeping of records. It is recommended that a dry fireproof structure, or at least a special room set apart for lubricants, be required. In addition, where the expense is justified, storage tanks with self-measuring pumps, heating coils and adequate equipment for installing and handling the drums and shipping containers should be provided.—*Electric Railway Journal*, July 19, 1924.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed. Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Direct-Current Generator, High-Voltage

This generator consists of a Tesla coil excited by a vacuum-tube oscillator, the voltage across the Tesla coil being rectified by a kenotron. The frequency is about 2×10^6 cycles per second. In series with the kenotron is a condenser which is charged to the maximum voltage of the Tesla coil. The high-voltage direct current is taken from the terminals of this condenser. The voltage is limited by that which the kenotron will support (100,000 volts). Using a condenser of 0.006 mf., the ripple will be, theoretically, less than 0.1 per cent with a voltage of 100,000 for any current less than 0.1 amp., provided the variations in the plate voltage to the vacuum tube do not exceed this limit.—*S. S. Mackeown, California Institute of Technology, Pasadena, Cal.*

Heat Studies

The following researches have been made in co-operation with the American Society of Heating and Ventilating Engineers: (a) Invention of a heat transmission meter and the measurement of heat transmission in building structures, (b) air leakage through openings in buildings, (c) development of a dust counter or dust meter and the measurement of air dustiness, and (d) critical velocities of steam and condensate mixtures in pipes.—*H. W. Brooks, Bureau of Mines, Pittsburgh.*

Inductive Co-ordination of Power and Communication Lines

Curves have been prepared based on the new "principles for protecting telegraph lines against three-phase lines" which were issued by the V. D. E. They give a definition of the conception "degree of danger" and "degree of disturbance" for the purpose of simplifying calculations. Calculations have been made both for the electrostatic and electromagnetic influences, for 100,000, 60,000 and 30,000-volt lines.—*Central Station Department of the A. E. G., Berlin, Germany.*

Light, a Primary Standard of

An investigation has been made of the luminous properties of the black body at the melting point of platinum. Use of this radiator at this temperature is recommended as a solution of the problem of a primary standard of light.—*H. E. Ives, Nela Laboratories, Cleveland.*

Mercury-Arc Rectifiers

A 1,500-amp. rectifier has been developed, with twelve electrodes. Vacuum is maintained by means of a mercury injection pump which does not contain any moving parts and is heated by the induction effect. By connecting two injection pumps in series it was made possible to cut out the rotating oil pump for long periods of operation (up to several weeks).—*Allegemeine Elektrizitäts-Gesellschaft, Berlin.* [For some reason this country is far behind Europe in the use of large mercury-arc rectifiers for railway service.—EDITORS.]

Mines, Gaseous, Portable Battery Plant for

Tests have been completed and approval given for use of a storage-battery truck equipped with a 220-volt battery sufficient to operate a coal-cutting outfit. The truck is brought near the coal-cutting machine and is safely connected to it by a cable, thus obviating throughout the mine dangerous electric wiring, which is one of the sources of explosions.—*Bureau of Mines, Pittsburgh.*

Plating with Cadmium

Cadmium plating as a protective coating for nuts, bolts, and threaded materials formerly sherardized and galvanized, has been developed.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Transmission Lines, Extra Weights on Suspension Insulators to Limit Swinging

The pressure of the wind on overhead lines makes the insulator chains swing out to such a degree that the line sometimes sparks over to the cross-arm. In many cases insulator breaks are due to the suspended chain being unloaded when the poles are not of equal height. This is especially the case when the tower is lower than the two adjacent ones. To reduce swinging, weights can be suspended from insulator chains. The magnitude of such weights for various practical cases has been computed and published in the *A. E. G. Mitteilungen*, May 1924, page 171.—*E. Iltgen, Berlin.*

In Progress or Purposed

Alloys, Data on

Data on numerous alloys—corrosion-resistant, heat-resistant and those used in electrical resistors—have been collected and are available in tabular form. The information comprises the maker's name, trade name, chemical composition, form (such as rods, sheet, etc.), uses for which it is recommended, typical actual applications, density, melting point, total contraction, machining, forging, welding and brazing qualities, cold reduction and precautions to be observed.—*American Society for Testing Materials, Philadelphia.*

Coils, Test for Short-Circuit in

Two similar armature or field coils are compared by connecting them as two branches of an alternating-current bridge and using a telephone receiver to indicate the balance. If the ohmic resistance of one of the coils is increased, owing, say, to a loose connection, the intensity of the receiver note is raised. If, however, an unbalance is produced by short-circuiting one or more turns of a coil, there is a distinct rise in the pitch of the note emitted, presumably an octave. A theoretical investigation of the cause of this phenomenon would be of considerable interest.—*C. W. Eisenmann, Nebraska City, Neb.*

Insulators and Refractories, Cyanite in

The possibility of obtaining the desirable properties of sillimanite in refractories and high-tension electrical insulators by utilizing cyanite as the principal body ingredient, is to be investigated. A study of the rate of inversions of cyanite to sillimanite and possible means of alternating this rate has been started. The cyanite under investigation is a tabled concentrate from a rock which also carries large amounts of quartz and considerable rutile.—*Ceramic Experiment Station of the Bureau of Mines, Columbus, Ohio.*

Rural Electrification

The demand for rural service continues to be felt throughout the country, and types of construction and material economically suited for this service are receiving careful attention. The low-load factor experienced in rural service has made advisable some form of transforming equipment which will reduce the core loss during light or no-load periods, and progress is now being made in the development of equipment for this class of service. Also research work is being done to see how much power can be used by the rural areas in different sections of the country.—*Frank G. Baum, San Francisco, Cal.*

Suggestions for Research

Illumination, Asymmetrical Distribution of

Various characteristics of asymmetrical distribution have been incorporated in equipment for residence streets and thoroughfares, for the purpose of concentrating more light in useful direction. The problems involved are rather complex, and there is still considerable difference of opinion as to what is most desirable in various classes of streets, with and without foliage. Considerably more practical experience and experimentation are necessary before a general agreement among engineers can be expected.—*G. H. Stickney, Harrison, N. J.*

Lightning Arresters

The real present need of the manufacturer for future progress with arresters is not so much in actual apparatus development as in getting more specific and definite data on conditions to be met in service. He needs to know much more definitely what the surge voltages are, in magnitude, duration and frequency of oscillation and of occcurrence; also to what values these surge voltages may be reduced before reaching and damaging the apparatus to be protected.

Reactors, Current-Limiting

Several papers and the discussion on the subject at the 1924 annual convention of the A. I. E. E. seem to indicate that ferther progress in design may be achieved along the following lines: (a) The best relative position of the three reactors of a set to obtain a maximum of inductance and the least mechanical forces; (b) a wider application of the concept of magnetic permeance and of expressions for the stored magnetic energy; (c) some experiments with flexible conductors in transparent oil to determine the actual mechanical forces and natural shapes of maximum inductance.

Steam Turbines

Among the important problems to le solved are: (a) More suitable material for blading and means to safeguard its reliability; (b) blade fastening to the wheels or rotors and the lacing or shrouding; (c) the balancing of large rotors; (d) the keeping of the length of blades, blade speeds and stresses within reasonably safe limits, while reducing the "leaving" losses to a minimum.—*Power Stations Committee of the A. I. E. E.*

Synchronous Machines, Tufted Poles for

In machines provided with a starting or amortisseur winding on the poles the pole faces are often slotted or "tufted." This causes rapid fluctuations of the magnetic flux in the stator teeth, and it is desired to ascertain (a) the extent to which slotting is really useful in starting or in reducing hunting and (b) what its effect is upon the core loss in stator teeth.

Turbo-Alternators, Circulating Cooling System for

The closed cooling system for large turbo-alternators consists in using the ventilating air over and over again and removing its heat by means of an arrangement similar to that of a surface condenser. This insures clean, dustless air, reduces fire danger, permits the use of the waste heat in the boilers, etc. Among further improvements of this system, the following have been suggested: (a) Substitution of an inert gas to eliminate internal fires in the machines; (b) use of a substance other than air to increase convection of heat and the amount of heat per unit volume of the medium; (c) a mechanical refrigeration cycle where cooling water is expensive.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Philadelphia's New Station

It Is to Be Erected on Erie Avenue and Cost $12,000,000—Stone & Webster Have Contract

CONTRACT for the erection of the great steam generating station on the Delaware River that the Philadelphia Electric Company has had in contemplation since last year has been awarded to Stone & Webster, who will act as the company's agents in letting sub-contracts. The site selected is on Erie Avenue in the Richmond district of the city and has a frontage of 1,200 ft., being 970 ft. deep and 1,400 ft. in the rear. The plans call for the erection of one building divided into three main sections. It will be of steel-frame and reinforced-concrete construction. The building permit is said to have carried with it the largest fee ever paid in the history of the Philadelphia inspection bureau, the city deriving from its approval of the plans $5,562.

The total space in the generating plant is estimated at 1,388,600 sq.ft. The boiler house, which will be four stories, will contain 706,000 sq.ft., while the turbine house and the switch house, both of which will be three stories, will have 255,600 sq.ft. and 397,000 sq.ft. of floor space respectively. The buildings will cover an area of 929 ft. by 600 ft. There will also be ten tanks, each having 2,000-gal. capacity, on the site.

The Richmond plant is ultimately to have a rating of 600,000 kw., greater than any now in operation, and will cost approximately $12,000,000. There will be twelve turbo-generators of 50,000 kw. each. The plant forms part of the company's fifty-million-dollar expansion program. It will be erected in three 200,000-kw. units, and it is the first of these units on which work is now beginning. Plans for the immense power house have been drawn by the company's own engineers under the direction of W. C. L. Eglin, vice-president and chief engineer. The architect of the building is John T. Windrim.

Idaho Power Company Puts Case Before Public

As was reported on August 2, the Idaho Power Company of Boise has filed with the United States District Court a bill of complaint asking the court to review the valuations, rate decisions and orders of the Public Utilities Commission of Idaho affecting the company. It is alleged that these orders are based on three erroneous premises. First, the company charges that its property has been undervalued by approximately $4,000,000; second, it holds that the rate of return allowed by the commission on the valuation set by the commission is too low, and, third, it asserts that certain rates, such as those for irrigation power and for heating power, are set at a non-compensatory figure.

W. R. Putnam, vice-president and general manager of the Idaho Power Company, in a statement to the public explaining the company's action, says in part: "While we had hoped to postpone this action for some time so that the present rates under which the company furnishes service could be fairly tried out, nevertheless we are confronted with a situation which, in our opinion, requires immediate action." He goes on to say that the court action was precipitated by the commission's recent order to show cause why the rates established by the commission in February this year should not be reduced 10 per cent.

Peace at Colorado Springs

Agreement Reached at Last, City Buying Power Company's Distribution System for $600,000

AFTER weeks of negotiations and a seeming deadlock the city of Colorado Springs has purchased the entire electrical distribution system of the Colorado Springs Light, Heat & Power Company for $600,000. An agreement was arrived at late last week between the City Council and the bondholders whereby the city acquires the distribution system and will thus be enabled to transmit power from the projected municipal plant. All pending litigation is to be settled at once and the municipality is to take title to the company's transmission lines from the Manitou hydro-electric plant to the city limits of Colorado Springs. Various other pieces of property now owned by the company on the watershed are included in the deal, but, along with its steam plant, the company retains title to substations A and B in the city, though the use of substation A is reserved to the city as long as it is required. The company plans to supply the various suburban communities outside the corporate limits of Colorado Springs.

The company is to operate and receive all revenues until completion of a steam plant by the city of Colorado Springs or until January 1, 1926. The city, in the meantime, is to continue to receive present rental for the use of the hydro-electric plant by the light company, or $36,000 a year. The terms necessitate that the company be thrown into the hands of a receiver, sold at public auction and purchased by the bondholders at auction before title to the property can be delivered to the city.

Reopen California Rates

Two Commissioners Dissent from 10 per Cent Increase Granted to the Southern Edison

LESS than a week after granting the Southern California Edison Company an emergency rate increase of 10 per cent, the California Railroad Commission issued an order reopening the case and calling a hearing for August 13 in Los Angeles. As recorded in last week's ELECTRICAL WORLD, page 281, the 10 per cent increase applied to all schedules except agricultural rates, was effective September 1 for a period of eight months, and was granted to the company because of the abnormal expense to which it has been put in generating steam power and purchasing energy from other utilities to meet the shortage of hydro-electric power in southern California.

The reopening of the case comes as the result of a dissenting opinion filed by Commissioners Clyde L. Seavey, the president of the commission, and Egerton Shore. They base their opinion on five points, namely:

The principle of basing rates upon average conditions over a period of years rather than upon special conditions of any particular year.

The unsoundness, as they see it, of granting emergency rates in the face of the company's present ability to pay 8 per cent dividends on its common stock.

The injustice, in their view, of imposing upon the company's consumers, the cities, industries and other public utilities dependent upon this company for their electric light and power, the extra burden of sharing the company's temporary losses in addition to the hardships and losses which they themselves are enduring from the same causes.

The incompleteness of the record in the proceeding, which did not include any report of check made by the commission's engineers.

The failure of the majority decision to take into account the accumulated surplus of the company, which, according to the dissenting commissioners' opinion, together with the contingency reserve and the estimated net revenue for the year, would enable the company to meet all operating expenses, depreciation annuity, interest on bonds and all dividends on stock, including 8 per cent on its common stock, and still leave a modest surplus.

The dissenting commissioners hold that if any conservation is required it should be made by reduction of the common stock dividend rather than by any temporary increase of rates to the company.

Oak Grove Plant Starts

Portland Electric Power's New 30,000-Kva. Hydro Unit Will Relieve Steam Auxiliaries

AT A TIME when the water shortage generally prevalent over the entire Pacific Coast is beginning to make itself felt in western Oregon, the Portland Electric Power Company has brought in the first unit of its Oak Grove hydro-electric development. Begun three years ago, construction of the Oak Grove project, involving the expenditure of $8,000,000 on the first unit alone, has been carried on steadily until at noon on August 4 the 30,000-kva. generator was synchronized with the other plants of the system and commenced to pick up load that in recent weeks had been carried only by crowding the steam auxiliaries to a point approximating the limit.

Twelve hundred excursionists, including Governor Pierce of Oregon and President Griffith of the N. E. L. A., made the 60-mile trip from Portland to the heart of the Cascade Mountains, to witness the starting of the plant, which was set in motion when President Coolidge pressed a button placed on his desk at the White House.

This plant, of which a preliminary description was given in the ELECTRICAL WORLD for July 28, 1923, page 199, derives its power from the normal flow of Oak Grove Creek, tributary to the Clackamas River, about 20 miles west of Cazadero, Ore. A diversion dam of concrete, arch type, approximately 190 ft. long and 69 ft. high, sustains a head of 45 ft. The backwater created by the dam covers 27 acres. From this intake the water is carried in a single-pressure conduit 6.6 miles to the summit of Cripple Creek Knoll, above the power house, which is directly below the knoll on the Clackamas River. This pipe is 9 ft. in diameter and is of $\frac{3}{16}$-in. to $\frac{11}{16}$-in. steel, fabricated and erected by the Willamette Iron & Steel Works, Portland. For the most part the flow line follows the contour of the ground, except that certain canyons are crossed on steel span bridges and four hills are tunneled.

The fall between the intake and the entrance to the penstock at Cripple Creek Knoll is less than 190 ft., which is the height of the surge tank there. The conduit is designed to carry 400 sec.-ft. The penstock, 1,360 ft. long, 8 ft. in diameter at the top and 6 ft. at the bottom, is made of $\frac{3}{8}$-in. to $1\frac{7}{16}$-in. steel. At the top is a 66-in. Johnson valve that can be operated from the power house and that will close automatically in thirty seconds.

CAPACITY OF UNIT IS 30,000 KVA.

To an I. P. Morris, Pelton Water Wheel Company 35,000-hp., 514-r.p.m. vertical reaction waterwheel is connected a General Electric Company alternating-current generator rated at 30,000 kva., 11,000 volts, 60 cycles, 514 r.p.m., with a 90-kw., 250-volt direct-connected exciter. The static head on the wheel at the power house with no water flowing is 922 ft. The operating head under full load will be 860 ft.

Adjacent to the plant is the steel switch yard and substation, where three Westinghouse outdoor-type, water-cooled 10,000-kva., three-phase transformers, having 5 per cent full-capacity taps, are delta-connected to deliver the transmission voltage of 66,000. When the second unit is installed these transformers will be star-connected and will operate at 115,000 volts primary. Connection is made with the present system at the Cazadero plant of the company over a steel-tower transmission line, designed to carry two circuits, 18.71 miles long, containing 144 towers of an average height of 72 ft.

A feature of the project is the installation—the first in the Northwest—of a Western Electric Company carrier-current telephone system from the power house to the company's Station L, a steam plant in Portland.

The ultimate rating of the plant will be 105,000 hp., in three units, and its cost complete is put at $15,000,000.

Details of Crawford Avenue Station

Designers Expect a Heat Consumption Reaching 10,265 B.t.u. per Kilowatt-Hour—Thermal Efficiency of 33.2 per Cent—Economizers and Regenerative Air Preheaters

VERY little information has been available about the new Crawford Avenue station of the Commonwealth Edison Company in Chicago, and American engineers will be interested in some details of the new station given in a paper on "Steam Turbines" by Sir Charles Parsons at the recent World Power Conference in London. The turbine details apply only to the unit now building in England.

Steam is generated, the paper says, at 600 lb. pressure and supplied to the stop valve of the high-pressure turbine at 550 lb. pressure, superheated to 750 deg. F. After expansion in the high-pressure turbine to a pressure of 100 lb. above atmosphere, it is led back through a well-lagged pipe into a reheater in the boiler house, from which it is returned to the intermediate-pressure turbine at a temperature of 700 deg. F. The high-pressure and intermediate-pressure turbines run at 1,800 r.p.m. and drive alternators of 15,000 kw. and 30,000 kw. capacity respectively. Further expansion takes place in the intermediate-pressure turbine to a pressure of about 2 lb. absolute, at which pressure the steam enters the low-pressure cylinder, to be expanded to the condenser vacuum.

The low-pressure turbine drives a 5,000-kw. alternator at 720 r.p.m. Owing to the lower revolutions of this turbine, the area provided in the final stage is so large that blades of normal profile, but set at a slightly greater discharge angle, can be employed. The steam is condensed in twin surface condensers with the tubes vertical and having a total surface of 56,000 sq.ft.

About 22 per cent of the total steam entering the turbine is used for feed-water heating. It is extracted from the turbines at three points, the feed water being heated up from 65 deg. F. to 315 deg. F. in three stages before entering the economizers. A heat consumption of 10,265 B.t.u. per kilowatt-hour is anticipated, or a thermal efficiency (from steam to electricity) of 33.2 per cent. For recovery of the heat in the flue gases economizers are used for a final stage of feed-water heating. Air preheaters are also used, a regenerative process being employed in the latter to heat up the incoming furnace air.

The boiler plant is expected to have an efficiency of 86.5 per cent. After allowing about 3 per cent for the total power absorbed by the auxiliaries, an over-all thermal efficiency (from coal to electricity) of 27.80 per cent is anticipated. This is on the basis of a boiler pressure of 600 lb. per square inch.

International Commission on Illumination Meets

From July 22 to July 25 the sixth session of the International Commission on Illumination was held at Geneva, Switzerland. Dr. E. P. Hyde, director of research at the Nela Park Laboratories, Cleveland, presided, and C. O. Mailloux, Clayton H. Sharp and other American delegates were in attendance.

H. E. Ives, of the United States, presented a paper on the adoption of a primary standard of light, and reports were submitted by the French and American committees. In connection with the latter Dr. Sharp submitted the following resolution:

"(1) That the International Commission on Illumination recommends the international adoption as the primary standard of light of the brightness of a black body operated under conditions which are subject to accurate specifications; (2) that the commission recommends the national laboratories to take steps to formulate standard specifications for the construction and operation of the black body as a primary standard of light, and (3) to fix upon a definitive figure for the brightness of such body expressed in international candles per square centimeter."

Reports from the French and Italian committees on the vocabulary of the lighting art were submitted. A proposed international vocabulary in the English, French, German and Italian languages is contemplated, and on the suggestion of Dr. Mailloux a small committee with a Swiss as permanent chairman was appointed to undertake the work. Dr. Mailloux said that the International Electrotechnical Commission would do all in its power to assist, but that it would not be possible for it to add to its present work an additional heavy task.

Other subjects dealt with by the commission at this meeting were standards of light suitable for photographic sensitometers and heterochromatic photometry. K. S. Gibson of the United States gave a paper on "The

Relative Visibility Function," and a resolution was passed that the commission adopt at the session being held a provisional table of values for this function. A committee was appointed to study all matters relating to colorimetry.

Prague Management Conference Attracts Eleven Nations

Austria, Belgium, Czechoslovakia, France, Italy, Germany, Jugoslavia, Poland, Roumania, Russia and the United States were represented at the International Management Conference held at Prague last month soon after the World Power Conference at London, most of these countries having professional engineers as well as industrial representatives in attendance. Among the Americans, who presented the larger part of the papers, were L. W. Wallace, Calvin W. Rice, W. S. Murray, John R. Freeman, Robert Sibley, H. V. Bozell and Mrs. Frank Gilbreth.

No new theories and no particularly new data or facts with reference to scientific management were presented or developed at the conference. It had not been anticipated that there would be. It was primarily a presentation of results, experiences and methods which had been found worth while—a comparison to a large degree between European and American methods, the Europeans saying frankly that they had much more to learn from America than they expected America to learn from them. It was made clear that scientific management pays, and the existence of a sympathetic attitude toward it on the part of labor, even in Russia, was reported.

There were eight regular business sessions at which the papers were put before the delegates. These were not followed by a great deal of discussion, Among the topics were the Taylor Society classification of fundamentals, accidents and illness and the relative disorganization resulting from them, profit sharing and bonus systems and vocational education. Inspection trips to industries in and around Prague added interest and diversity to the gathering, and entertainment was provided in hospitable measure. The Czechoslovakian government was officially represented at the conference, and there was a reception at the palace of the President.

Electrical Growth in a New-Old Country

Meeting of Czechoslovakian Electrotechnical Association Marks the Progress of Republic Both in Manufacture for Export and in Domestic Development

[*Editorial Correspondence of the* ELECTRICAL WORLD]

PRAGUE, CZECHOSLOVAKIA.

THE annual convention of the Czechoslovakian Electrotechnical Association and the accompanying manufacturing exhibit of new advances during the year have just come to a close. What one could get from this convention, interpreted by English-speaking and American-traveled Czech engineers, coupled with the observation of the Czech exhibits, leads to the conclusion that, while they are watching American practice and learning from it and the practice of other countries, yet they have an initiative and ability themselves that will mean much for electrical advance in Czechoslovakia in the near future. Any prediction about future development anywhere in Europe, however, must be contingent upon there being no more economic and currency upsets.

Czechoslovakia as a state is new, but her traditions as a group of peoples go back into early European history. Her electrical industry has many substantial parts, developed when she was still Austrian, so there is plenty to build on. Moreover, there is a new national spirit and initiative which may mean much. The noted Skoda Works are part of her electrical industry now, and the exhibits showed that there are many others developing and producing first-class material. Czechoslovakia is, right now, hemmed in by tariff barriers which make it hard for her to ship all the surplus production that she would like to ship. Estimates indicate that her industries could easily, with present plant and without abnormal pressure, produce twice as much as they are now producing. In other words, they are operating at about 50 per cent capacity. For this reason she has accepted some Russian orders for power-plant equipment on terms which are not entirely to her liking, but upon which she believes she will lose nothing. These terms are 15 per cent on signing of the order, 15 per cent upon shipment of material, 15 per cent upon erection of the material in the plant, and 55 per cent in seven years. As to the 55 per cent, Czechoslovakia imports a good deal of several raw products so that she figures there is a balance of credit upon which it will be possible to draw in case of necessity.

AMBITIOUS HOME PROGRAM

With outlets limited and with the widespread interest in electrical development, there is strong sentiment toward going ahead with a real program of development in Czechoslovakia herself. Though not exactly rich, she inherited no debts, her currency is staying on a pretty good level, and she has excellent agricultural lands, some water power, more or less low-grade fuel. The people are looking to electricity to help them materially. The use of electricity has barely begun in the way known in America, and its appeal is all the stronger to those who have not had so easy a mechanical civilization as Americans now enjoy.

The exhibit showed developments of low-power-factor motors directed principally to rural applications so as to reduce transformer and line costs and losses as much as possible. There was a great increase over previous exhibits in percolators, flatirons, electric heaters, concrete "heat-storage" stoves, small tools and other motor-driven equipment and various household devices.

From the equipment standpoint, the exhibit showed 35-kv. cables; heavy switches both oil and disconnecting, the latter with some interesting detail development; insulators, bushings, relays particularly fitted to limit load demands where rates are still high and power saving important; overhead-line equipment of advanced design, and other things which showed a real advance in the past year incorporating individual ideas. There were also a substantial radio exhibit and very good telephone exhibits.

FAMILIAR CONVENTION TOPICS

As to the convention itself, some of the subjects were much like those considered at American conventions. Primary interest, in this country of low-grade fuels, centered on the design of the new 60,000-kw. steam-power plant which is to burn the extremely low-value coal of Czechoslovakia. There was also well-sustained discussion of methods of heat balance in central stations, and intense interest was manifest in the subject of the best organization for power-plant operation and a code for operation. Lighting in industrial plants and the relation of illumination to production was another popular topic—a somewhat new one here. The development of relays for the limiting of power demands was described and attracted much attention, as did also the methods for most effective impregnation of poles.

All of the meetings of the association were well attended and full of interest. Usually from 250 to 300 persons were at the sessions. Americans were made doubly welcome, for the Czech looks to America as his greatest friend. He points to Chicago as the "third largest Czech city" in the world. He is watching American practice.

H. V. BOZELL.

Rural Electrification Congress to Be Held in France

There will be held at Lyons, France, in the second half of October the first congress of the National Federation of Societies for Rural Electrification, accordng to Chester Lloyd Jones, commercial attaché at Paris. The conference has the support of the Ministries of Agriculture, Public Works, and Interior, as well as of all of the large private organizations interested in agriculture and the application of electricity thereto. Among other things it will consider the problems which must be overcome in order to increase the use of electricity in rural communities and will develop a movement looking toward the rapid consummation of the electrification program to which the government has given its approval. During the conference the larger French electrical companies will show their products and will carry on a two weeks' demonstration of the application of electrical appliances to various phases of rural life.

News from the National Capital

California Fish Commission Denounces Klamath River Permit—Inevitable Delay at Muscle Shoals—Green River Project—Suit Over Georgia Dam

THE action of the Federal Power Commission in granting a preliminary permit to the Electrometals Company for a project on the Klamath River has been followed by harsh denunciation of the commission emanating from the California Fish and Game Commission. The excoriation of the commission is being supplemented by similar attacks from the Hearst newspapers, from the supporters of Senator La Follette and from the advocates of public ownership in Los Angeles and other cities. It is understood that the administration is paying little attention to this clamor, although it is expected that much will be heard of the Klamath River case.

The commission is at a loss to understand why the granting of this preliminary permit should have provoked such a storm. At the same time it is pointed out that there is no more reason for the elation being displayed by those who have resented the holding up of power projects because of solicitude for the fish. This preliminary permit simply gives the right to develop power on the Klamath, provided it can be shown that arrangements can be made whereby fish will ascend a high dam. Before private enterprise would be justified in making the experiments necessary, it is pointed out, it would have to have assurance in advance that the rights would be granted if it should demonstrate the truth of its claim. The belief is expressed that the granting of this preliminary permit will do more than any other one thing to settle this controversy which has raged so bitterly for a long period of years.

MUSCLE SHOALS DELAY

That the failure of Congress to take definite action with regard to Muscle Shoals is certain to result in delay in utilizing the power after the dam and power house have been completed is a fact on which comment is heard. If, for instance, bids from the Southern power companies should be called for, it would be necessary, before power could be delivered to any one of them, to install a large transformer. This would have to be built to special specifications. Were the order placed today, it is contended that it could not be ready for June 15, 1925, when it is expected that the project will be in a position to operate.

It also is pointed out that the only transmission line connecting Muscle Shoals with any outside system is the 30,000-kw. line of the Alabama Power Company connecting Sheffield with Cordova, which is capable of handling only half of the output of the steam plant. This fact, however, is due to the failure of the Alabama Public Service Commission to furnish a certificate of convenience and necessity which the Alabama Power Company has been insisting upon for two years. The power company has had the right-of-way and has been anxious to construct an adequate transmission line.

An application for a preliminary permit covering a 60,000-hp. development at the Split Mountain site on Green River in Uintah County, Utah, has been filed with the Federal Power Commission by A. E. Humphreys of Denver and J. H. and Mary E. Ratliff of Vernal, Utah. The proposed project conflicts with plans of the Utah Power & Light Company and would not be of particular interest were it not for the fact that the applicants are known to possess large financial resources.

Mr. Humphreys and his associates propose to develop a head of 160 ft. and to install five units capable of generating 60,000 hp., which is to be used in the manufacture of fertilizer at the nearby phosphate properties of the applicants. In addition, however, it is proposed to divert sufficient water to irrigate 3,000 acres on the east side of Green River and 8,000 acres on the west side of the stream.

The Utah Power & Light Company now holds a preliminary permit and is actively working on the plans for a project at the Flaming Gorge site several miles above Split Mountain. The Split Mountain site probably would be the next step in the power company's plan of expansion. It is anticipated that the power company will oppose the Humphreys application vigorously. The general information available as to the Split Mountain site indicates that fairly cheap power can be developed there after the Flaming Gorge reservoir has been constructed.

WHAT CONSTITUTES CONSTRUCTION?

Action on the part of the Rock Creek Power Company of Missoula, Mont., in beginning a small amount of construction work on the eve of the expiration of its license covering a small project on Rock Creek in western Montana has raised the question of how the commission can meet such situations. If construction work is not begun before the expiration of time fixed in the license, the license can be revoked by a simple written order from the commission, but when construction work actually has begun the license can be revoked only through court proceedings. From a legal point of view, it seems that the licensee will have complied with the letter of the law if he makes a few scratches on the project. While advantage may be taken of the law in this regard, the feeling is that a change in the law is unnecessary since the licensee is throwing away a portion of the time allowed for completion. It will be possible for the commission to terminate the license on the latter date. If another applicant who is prepared to make the development promptly should appear, an injunction then could be sought.

THE FLINT RIVER PROJECT

The injunction sought last week in the federal court of the Southern District of Georgia against the project of the Georgia-Alabama Power Company in the Flint River near Albany, Ga., as reported August 9, on page 289, is in compliance with a request made by the Federal Power Commission eighteen months ago. The Chief of Engineers, acting on a declaration of intention filed by the power company, held the proposed dam to affect navigation. In compliance with his recommendation the federal government took jurisdiction. The power company's contention is understood to be that the dam does not affect navigation.

It is stated at the offices of the commission that the attitude of the Georgia-Alabama company will be resisted vigorously. To allow this suit to be lost would constitute a precedent which would undermine the whole water-power act. It occasionally happens that the importance of a project locally influences a judge to return an adverse decision in a case of this sort. In a long line of cases, however, the War Department ultimately has won the suits arising over its control of streams.

The thought was expressed that it is poor strategy to proceed with a project without a license when the federal government has taken jurisdiction. The government is practically certain to win its contention in the courts.

Alaskan Power Sites and the Wood-Pulp Industry

Ample power resources are possessed by southeastern Alaska to handle the maximum possible output of wood pulp, even when conditions become such that there will be a demand for all the pulp the territory can furnish. This is shown in a report just made by J. C. Dort, an engineer of the Forest Service. Mr. Dort's report corresponds with the large amount of data on file at the Federal Power Commission, indicating that the great potential pulp possibilities of the territory have behind them the very substantial advantage of well-located and adequate water power.

Notwithstanding pessimistic utterance on the subject, all of the studies in the possession of the Federal Power Commission agree that the day will come when Alaska will be the most important source of wood pulp. These same studies also demonstrate, however, that there is great difference of opinion as to when it will become feasible to develop this resource. It does not depend entirely on the Canadian situation as Scandinavia is nearer to New York than is Alaska. While the Canadian resources are being depleted, the reports show that Canada will continue to be a factor in the matter of pulp supply for many years to come. Those contemplating power developments in southeastern Alaska are trying to establish whether or not the probabilities favor Alaska's resources being required within the next decade. Almost that long would be required to finance the projects and construct them in an area having very short working seasons. Some authorities are of the opinion that there will be no substantial demand on Alaska for pulp until the pulp wood in the Puget Sound area has been used.

Judges for House-Lighting Contest Appointed

Word has just been received by the Lighting Educational Committee from G. D. Shepardson, professor of electrical engineering of the University of Minnesota, and G. H. Anderson, professor in the University of Toronto, that they will accept positions as national judges for the better home-lighting contest. This completes the list of seven judges, the other five being Franklin T. Griffith, president N. E. L. A.; William McAndrew, superintendent of schools, Chicago; Mrs. William Brown Meloney, editor *Delineator;* B. C. Forbes, editor *Forbes Magazine,* and Miss Sarah L. Rhodes, principal Public School 28, Brooklyn, N. Y. These judges will consider only the prize-winning primers and essays which are sent to New York from all the communities in the United States and Canada. Local judges in each community will have the responsibility of judging primers and essays as submitted by the local school children.

Assurances have been obtained from leading school authorities in several sections of the country that the schools in their districts will co-operate in the home-lighting contest by having the home-lighting primers distributed to the scholars. In extending their co-operation educators have stated that the eyesight problem is one of the most serious with which the schools have to contend. Omaha, Pittsburgh and Chattanooga are among the cities whose school superintendents have promised assistance.

George S. Anderson, manager of the public service department of the Niagara Falls Power Company, who is assisting W. E. Robertson in organizing his New York State district, reports interest and anticipates abundant co-operation from the Northern New York Utilities of Watertown, the St. Lawrence Valley Power Company and St. Lawrence County Utilities of Potsdam, the Adirondack Power & Light Corporation of Schenectady, the Utica Gas & Electric Corporation and the New York State Gas & Electric Corporation of Ithaca, all important upstate companies with large territories.

Bureau of Mines on Safe and Unsafe Electric Equipment

The use of open-type electrical equipment which fails to safeguard against the transmission of sparks and flame to gaseous and dusty atmospheres in coal mines constitutes a real menace to the American miner, according to a statement just issued by the Department of the Interior. Records of the Bureau of Mines covering twenty-six coal-mine disasters and fires due to unsafe electrical apparatus show the loss of five hundred human lives in addition to great damage to property. An open-type electric coal drill used in a gaseous mine in West Virginia was the probable cause of the death of twenty-seven miners, the bureau asserts. A half-safe type of electric coal-cutting machine used in a gaseous mine in Pennsylvania was probably the cause of the death of thirty-six men. An unapproved, unsafe type of flame safety lamp used in a gaseous and dusty mine in Utah was the alleged cause of the death of 171 men. All three disasters happened within the past six months and would seem, according to the bureau, to have been avoidable if proper equipment had been used.

During the past fourteen years the Bureau of Mines has, in co-operation with manufacturers of electrical machinery and equipment for mines, conducted thousands of tests on various machines and apparatus submitted by the manufacturers to determine whether the device is safe for use in explosive mine atmospheres. If the machine or any part of it is not safe, the bureau and the manufacturer work together to eliminate the unsafe features. When the machine finally passes the bureau's tests it is formally approved for use in coal mines where hazards from gas and dust exist. Several classes of equipment have been tested, and there is a steadily growing list of approved equipment recommended for use wherever such equipment is needed.

Detailed information relative to the hazards of electric sparks and arcs in coal mines is given in Serial 2626 by L. C. Ilsley, electrical engineer, copies of which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D. C.

Many Topics for New England N. E. L. A. Convention

Plans for the sixteenth annual convention of the New England Division of the National Electric Light Association are approaching completion. The meetings will be held at the Hotel Wentworth, Portsmouth, N. H., Sept. 10-12, the scene of the first convention of the organization. The program follows:

WEDNESDAY, SEPTEMBER 10

Evening.—Address of welcome; address of President S. Ferguson; reports of committees on accident prevention (F. W. Randall), insurance (H. P. Hood), rural electric service (H. M. Parsons), and taxation (Bowen Tufts).

THURSDAY, SEPTEMBER 11

Morning.—Commercial session: Power Bureau, address, "Selling Public Service Corporations to the Public," John S. Lawrence, Boston; Rate Bureau, address, Prof. T. H. Dillon, Harvard University School of Business Administration, Cambridge, Mass.; Lighting Bureau, address on the better home-lighting contest, P. B. Zimmerman, Cleveland.

Afternoon.—Appliance Bureau, addresses, "Merchandising," L. C. Pedlar, New York; "Electrical Appliances from the Housewife's Viewpoint," Mrs. E. MacDonald, field editor *Modern Priscilla;* "Heavy-Duty Cooking," Grant Call, Chicago; reports from Contact Bureau (H. B. Gilmore), Wiring Bureau (R. S. Hale), Electric Transportation Bureau (E. S. Mansfield), and New-Business Bureau (H. J. Walton).

FRIDAY, SEPTEMBER 12

Afternoon.—Parallel sessions: Technical Section, papers, "Automatic Substations for 1,500-Volt Suburban Electric Railway," C. A. Butcher, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; "Operating Experience with Automatic Equipment on an Edison System," F. D. Wyatt, Union Gas & Electric Company, Cincinnati; "The Fynn-Weichsel Motor," E. W. Goldschmidt, Wagner Electric Corporation, New York. Accounting Section, committee reports on fixed capital records (L. S. Goodman), credits and collections (W. D. Dyer) and preservation of records (W. F. Stevens), a discussion on "Allocating Expense and Overhead Charges to Merchandising Departments."

Evening.—Public Relations session: Addresses, P. L. Thomson, manager publicity department Western Electric Company, Inc., New York, and other speakers.

Coming Meetings of N. E. L. A. Committees

Committee meetings of the National Electric Light Association are announced for August and September as follows:

CHICAGO

August 26—Appliances; lighting; power.
August 27—Customer relations; electric cooking and heating; electric domestic refrigeration; transportation.
August 28—Executive committee, Commercial National Section, and general conference of Commercial National Section committees.

NIAGARA FALLS, ONTARIO

September 18—Budget; classification of accounts and annual reports; customers' records and billing methods; fixed capital records; filing and preservation of records; merchandising accounting; payroll standardization; purchasing and storeroom accounting; securities accounting.
September 19—Executive committee Accounting National Section and general conference of Accounting National Section committees.

The September meetings above will be held in the Clifton Hotel. On September 22 the executive committee of the Public Relations National Section will meet in the Edison Building, Chicago, and on September 23 in the same place the national executive committee will meet. Subsequent meetings of Commercial National Section and Accounting National Section committees will be held in November in San Francisco and in December in Chicago respectively.

Franklin Institute's Centenary Celebration

On September 17, 18 and 19 Philadelphia will be the scene of a centenary celebration of the founding of the Franklin Institute and inauguration exercises of the Bartol Research Foundation. Elihu Thomson is chairman of the honorary committee of the centenary celebration, which numbers among its members Thomas A. Edison, Charles A. Coffin, Samuel Insull, Joseph B. McCall, Nicholas F. Brady and other men prominent in utility and industrial circles. William C. L. Eglin is chairman of the executive committee.

Among the speakers at the celebration are listed Elihu Thomson, Frank J. Sprague, A. E. Kennelly, John J. Carty, William D. Coolidge, Irving Langmuir, E. W. Rice, Jr., Major-General G. O. Squier, William Le Roy Emmet, Harold Pender, F. W. Peek, Jr., A. A. Michelson, Charles E. Mendenhall, Dexter S. Kimball and other distinguished American engineers and scientists, as well as eminent foreigners like Sir Charles A. Parsons, Sir Ernest Rutherford, Sir William H. Bragg, Prof. William L. Bragg, Prof. E. G. Coker, Prof. F. G. Donnan and Prof. John S. E. Townsend of England, Prof. Pieter Zeeman of Amsterdam, Prof. F. Haber of Berlin and Prof. Charles Fabry of Paris. Electrophysical topics will figure prominently in the program.

Briefer News

Rock Falls (Ill.) Municipal Plant Gives Up.—The City of Rock Falls, Ill., has signed a contract to purchase energy from the Illinois Northern Utilities Company. This means the shutting down of the sixty-thousand-dollar municipal plant and the connection to the Illinois Northern system of another municipality. Service is to begin not later than September 1.

Tide Runs Against Municipal Plants in New York State.—Three more communities in New York State have recently voted to go out of the business of generating or distributing energy and have turned instead to central-station service. These places are Newark Valley in Tioga County, which will be served by the Binghamton Light, Heat & Power Company; Sherman in Chautauqua County, which looks to the Western New York Electric Company for Niagara power, and Arkport in Steuben County, which will now go on the lines of the New York Central Electric Corporation. Boonville in Oneida County is to buy power from the Northern New York Utilities instead of making it at the village plant, and Theresa in Jefferson County is negotiating to lease its plant to a private utility company with the option of sale. Three other municipal plants, at Burdette, Tully and Clifton Springs, have ceased to operate within the last two years, finding central-station service more economical and reliable.

Oklahoma Town Closes Its Plant and Contracts for Central-Station Energy.—The city of Walters, Okla., has contracted to buy electric light and power from the Southwestern Light & Power Company, with general offices in Oklahoma City and generating plant at Lawton. It is estimated that the contract will save the taxpayers about $14,000 annually. During the period covered, which is three years with option of renewal for a like period, the municipal light plant will be closed down and held in readiness to give emergency service. The contract provides energy at slightly more than half the city's cost of manufacture.

Los Angeles to Vote on Power Bonds on August 26.—The City Council of Los Angeles has called an election for August 26 upon the sixteen-million-dollar issue of power bonds which the Bureau of Power and Light desires to float. Two previous issues for which indorsement was sought have been defeated—one for $35,000,000 in June, 1923, and one for $21,000,000 in May, 1924. The present figure is that indicated by the California Railroad Commission, at the request of the city, as in its opinion the amount the voters should grant. The resolution calling the election was vigorously opposed by one councilman, who maintained that the bureau is inefficient and will have to buy 87½ per cent of the power it needs from the Southern California Edison Company.

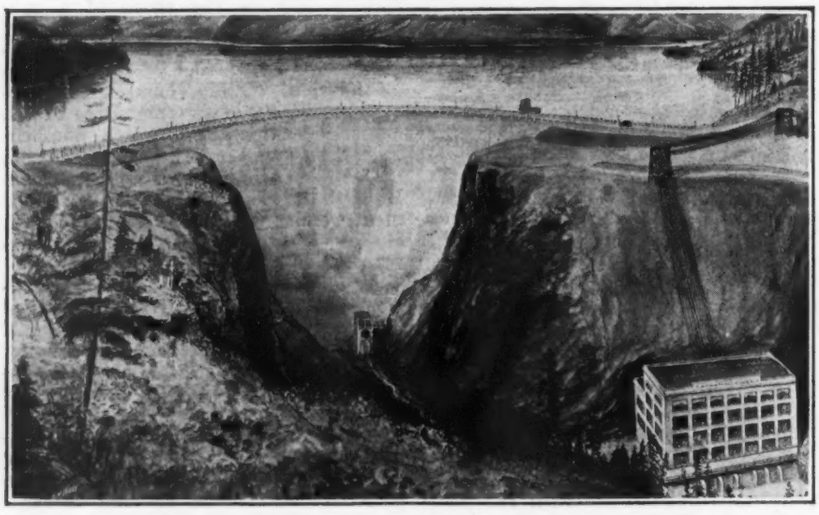
Boston Edison Plans Radio Publicity.—Early in September a new radio broadcasting station, to be known as station WEEI and rated at 500 watts, will be opened by the Edison Electric Illuminating Company of Boston and operated on a wave length of 303 meters. The station is now under construction at the offices of the company. Comprehensive programs of general interest and public utility concern are in contemplation.

Denver's Electrical Co-operative League.—Reports from Denver indicate that the Electrical Co-operative League, operating in that city and suburban territory, has entered its fourth year of activity in vigorous fashion. Following the adoption of a program for the new year which started July 1 and the election of officers, the league engaged in a drive the object of which was to insure the underwriting of required funds during the first month of the new year. According to S. W. Bishop, executive manager, more than 80 per cent of the quota was raised during the first week of July and the campaign is now centered in an effort to obtain the assistance of as many manufacturers and contractor-dealers as possible. Utility companies and jobbing interests are pledged 100 per cent.

University Research to Aid Public Utilities.—Extensive investigations of engineering problems affecting public utilities are to be carried out by the engineering experiment station of the University of Illinois in co-operation with a utilities research committee representing several of the largest utility companies operating in Illinois, according to an announcement by W. L. Abbott, chairman of the committee and chief operating engineer of the Commonwealth Edison Company. The committee is to furnish $25,000 a year for two years, and the university will furnish scientists, laboratories and equipment. Investigations on the fatigue of structural parts will include studies of the wear on axles, fans and other moving parts. Experiments with porcelain will be carried on with a view to increasing the efficiency of insulators. Refractories for water-gas furnaces will be investigated and studies of boiler-feed-water treatment will include an examination of the effect of various waters on the structural part of boilers.

Comprehensive Report on Installed Water Power in Wisconsin.—The Wisconsin Railroad Commission has just published a 575-page report containing complete data on dams and hydro-electric plants in that state. Of the 609 dams in the state 100 are used exclusively as power dams for public service purposes, 335 as power dams for private purposes, and 23 are used jointly as power dams for private and public service purposes. In addition, there are 115 dams not used for power purposes. The private power dams are used mostly for milling purposes, particularly by the paper industries. The investment in hydro-electric plants in Wisconsin is estimated to be in excess of $60,000,000. The Wisconsin River develops the largest amount of water power; the Chippewa River, in conjunction with the Flambeau, the second largest, and the others follow in this order: St. Croix, Menominee, Peshtigo, Oconto, Red Cedar, Apple and lower Fox. The largest hydro-electric development is at Wissota. It is owned by

Canyon Power House of Tacoma's Municipal Project



THE first unit of Tacoma's power project at Lake Cushman, Wash., is now well under way, and the two ends of the tunnel have been bored through 900 ft. of solid rock. This plant, it will be recalled, is to be built in the throat of the rock canyon of the North Fork of the Skokomish River, where the dam will rise 235 ft. above the bed of the canyon and will create a lake 10 miles long by about a mile wide. The first power unit will be installed a short distance below the dam in the canyon bottom, utilizing the pressure of the water in the reservoir, which is expected to generate 50,000 hp. Later the water will be used again at sea level to give an ultimate output of 90,000 hp.

the Northern States Power Company and has an installed capacity of 50,000 hp. The Kilbourn and Prairie du Sac dams, owned by the Wisconsin River Power Company, are the second largest. Other large water powers are at St. Croix Falls, Wausau, Big Falls, Jim Falls, High Falls and Johnson Falls. The report goes into great detail as to the location of rivers, drainage areas, water-discharge measurements, channels and control, and other hydrometric data.

Fight in Racine, Wis., Over Putting Wires Underground. — Public service companies and municipalities in Wisconsin are watching with interest a fight in Racine in which the Wisconsin Gas & Electric Company and the Wisconsin Telephone Company attack the efforts of the city to force wires of these companies underground on several streets. The companies claim that the city ordinance is invalid and that the costs of placing their equipment underground would be entirely inconsistent with the rates now in force. The dispute will be taken to the Railroad Commission.

Springfield, Ohio, in Deadlock Over Rates.—City officials of Springfield, Ohio, have failed to reach an agreement with the Ohio Edison Company on a new contract to supersede one which expired July 1. The present rate of 8½ cents for the first 30 kw.-hr., 6 cents for the next 30 kw.-hr. and 3 cents for all additional is to be continued until some agreement is reached. The city is demanding a rate of 7, 6 and 3 cents, while the Ohio Edison Company insists that it cannot grant a lower rate than 8, 6 and 3 cents to run a period of five years. An ordinance providing for the rate favored by the city commission will probably be passed and the dispute carried to the Ohio Public Utilities Commission for settlement. Talk of establishing a municipal plant is not taken very seriously.

Electricity in South Africa.—The use of electrical energy in industrial establishments throughout the Union of South Africa has increased considerably since 1915. The number of factories using electrical power has increased 75 per cent, while the total horsepower has increased 74 per cent. In 1922 the average horsepower for each factory was 42.6. Steam horsepower ranked first in the Union in 1915, but has since taken second place to electricity, the difference in favor of the latter becoming gradually greater from year to year. The total number of industrial plants using motor power has increased 56 per cent and the total horsepower 52 per cent. Water power is used in small proportions.

New York Central's New Freight Yard to Be Electrically Equipped. — With the exception of the steam locomotives that haul the cars, the largest and most perfectly equipped railroad freight yards in the United States, now being built by the New York Central Railroad at Selkirk, south of Albany, will be operated entirely by electricity. The new Selkirk yards cover an area 5 miles long and 1,000 ft. wide. Electric cranes will load and unload the cars, electric capstans and turntables will simplify their maneuvering, electric switches will shift them from track to track and electric machinery in the shops will repair them. An outstanding feature of the new yards will be a system of floodlights for night work. One hundred and ten towers, each 150 ft. high and carrying from two to five lighting units, will provide daylight conditions at night. The units will be so arranged that each will point in the direction of the traffic in the area it illuminates. The night lighting will, it is expected not only expedite traffic handling, but will reduce damage and pilfering from loaded cars.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 5 issue, page 50, for latest list.]

Conference of Electrical Leagues, Association Island, Henderson Harbor, N. Y., Sept. 2-6. Address Society for Electrical Development, 522 Fifth Avenue, New York.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 3-6. H. M. Stine, 212 Locust St., Harrisburg.

Association of Edison Illuminating Companies—Griswold Hotel, New London, Conn., Sept. 8-12. P. S. Millar, 80th St. and East End Ave., New York.

Michigan Electric Light Association—Hotel Statler, Detroit, Sept. 9-11. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

New England Division, N. E. L. A.—Hotel Wentworth, Portsmouth, N. H., Sept. 10-13. Miss O. A. Bursiel, 149 Tremont St., Boston.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 15-17. O. A. Weller, 900 15th St., Denver.

Colorado Public Service Association—Hotel Colorado, Glenwood Springs, Col., Sept. 15-17. J. F. Greenawalt, Mountain States Telephone & Telegraph Company, Denver.

Southeastern Division, N. E. L. A.—Birmingham, Sept. 15-18. E. T. O'Connell, Alabama Power Co., Birmingham.

Association of Iron and Steel Electrical Engineers—Pittsburgh, Sept. 15-20. J. F. Kelly, 513 Empire Building, Pittsburgh.

Great Lakes Division, N. E. L. A.—French Lick, Ind., Sept. 24-27. R. V. Prather, Illinois Mine Workers' Bldg., Springfield, Ill.

Electrical Supply Jobbers' Association, Pacific Division—Del Monte (Del Monte Lodge, Pebble Beach), Cal., Sept. 25-27. Albert H. Elliot, 502 Flatiron Bldg., San Francisco.

Association of Electragists International—West Baden Springs, Ind., Sept. 29-Oct. 4. L. W. Davis, 15 W. 37th St., New York.

American Electrochemical Society—Hotel Fuller, Detroit, Oct. 2-4. Colin G. Fink, Columbia University, New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 6-10. J. W. Welsh, 8 West 40th St., New York.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 6-7. C. H. B. Chapin, Grand Central Terminal, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Pasadena, Cal., Oct. 13-17. F. L. Hutchinson, 33 West 39th St., New York.

Kansas Public Service Association—Broadview Hotel, Emporia, Kan., Oct. 24-25. R. T. Smalley, Kansas Electric Power Co., Emporia.

Illuminating Engineering Society, Briarcliff Manor, N. Y., Oct. 27-31. N. D. Macdonald, 29 West 39th St., New York.

Andrews, N. C., Completes Its Unapproved Plant. — The hydro-electric plant on the Hiawassee River owned by the town of Andrews, N. C., with the transmission line and substation, is virtually complete and will soon be in operation. This development was undertaken by the town of Andrews more than a year ago at a cost of $350,000 for the purpose of providing the town with electric power for municipal purposes and also with power to sell to manufacturing plants and other industries. It was built above the navigable portion of the river, and the chief counsel of the Federal Power Commission found that that body had no authority to interdict the plant, notwithstanding that its erection has prevented any program for larger use of the river's power.

Canadian Official Suggests "Neutral Zones" for Water-Power Sites.—Discussing the development of the water powers of the Province of Quebec, Provincial Secretary Athanase David recently suggested the possibility of the creation of "neutral zones" around hydraulic developments, so that American capital would develop the water powers, build factories near by and be permitted to import raw materials for such factories without the payment of custom duties, shipping the manufactured goods out. "Our water powers are so numerous," Mr. David said, "that they are more than a hundred times sufficient for the use of a population such as we have. If it is true that the exportation of electric power, by permitting a neighboring country to increase the capacity of its factories, increases production, such increase necessitates a greater supply of labor. Knowing of this need for labor, a great many of our people go to where the demand exists. Why not seek, therefore, in developing and using in Quebec our electric power, to increase our production so as to keep our workmen home?"

New York Commission Decides Disputed Points and Authorizes Mergers. —The New York Public Service Commission has issued an order permitting the Northern New York Utilities, Inc., to exercise the franchises granted by the city of Rome to the Rome Gas, Electric Light & Power Company, which the first-named company has absorbed, no opposition being expressed by the city, and has decided that the consent of the towns to be crossed by the new transmission line from Boonville to Rome is not necessary, the lines being on private right-of-way except where highways are crossed. This action of the commission clears up the obstacles to the plans of the Northern Utilities which were alluded to in a previous issue. Other decisions by the commission allow the New York Central Electric Corporation to take over the Canaseraga Electric Company in Allegany County and the Distributors' Electric Company of Canisteo, Steuben County, and permit the Livingstor Manor Electric Company of Sullivan County to transfer a portion of its physical property to F. M. Woolsey and associates and the rest of its franchises, works and system to the New York State Gas & Electric Corporation.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in All Branches of the Electrical Industry

F. Wood, who has been many years in the service of the Mexican Light & Power Company, Ltd., Mexico City, has been appointed treasurer of the company to succeed Graham Fulton, recently resigned. This company, though operating in Mexico, was incorporated in Canada, with head offices in Toronto.

A. R. Frahm, who has been connected with the Northern States Power Company's properties at Grand Forks, N.D., has been appointed general superintendent of electrical and gas properties in Wisconsin with headquarters at Eau Claire. Mr. Frahm is succeeding George A. Mills, who recently severed his connection with the Northern States organization to affiliate himself with the public service interests at Kewanee, Ill.

Robert A. Jones, formerly general superintendent of the Pennsylvania Edison Company, Easton, Pa., has been made vice-president of the North Carolina Public Service Company, Greensboro, and general manager of the Florida Public Service Company, Orlando. The properties which Mr. Jones will manage are among those recently acquired by the General Gas & Electric Corporation and will be largely developed under his management.

Lois M. Anderson, who for the past year and a half has been employed in the Fowler (Ind.) office of the Interstate Public Service Company, has been made assistant to the director of public relations of the company's office in Indianapolis. Miss Anderson's duties will include work along educational lines in public schools, women's clubs and other organizations. She will also assist Mrs. P. W. Evans in carrying out the program of the women's public information committee. Previous to her connection with the Interstate company Miss Anderson spent ten years with the Indiana Bell Telephone Company as division instructor.

Charles A. Semrad, vice-president and assistant general manager of the Public Service Company of Colorado, and formerly directing head of the western division with headquarters at Boulder, has been designated as commercial manager to succeed R. G. Gentry, who has been placed at the head of a new department of public relations. Because of the anticipated merger of the Colorado Power Company with the Public Service Company of Colorado, the commercial department of the entire organization is being revamped. The western division of the latter company, formerly the Western Light & Power Company, has in so far as the commercial department is concerned likewise been placed in the reorganized department. All of the commercial activities will be directed from Mr. Semrad's office in Denver, it is understood. Assisting him in the operation of the department will be E. B. Ball, formerly commercial manager of the western division; F. F. McCammon, in charge of power sales; R. G. Munroe, in charge of gas commercial activities, and another executive from an outside Doherty property to direct electric merchandising activities.

W. C. Sharp New Vice-President of Middle West Utilities

W. C. Sharp, who was recently elected vice-president of the Middle West Utilities Company in charge of operations, as was announced in the August 2 issue of the ELECTRICAL WORLD, has

W. C. SHARP

been with that company for the last three years, the last year and a half of which he has been in charge of the work of which he now has supervision as vice-president. For about eighteen months after entering the service of the company in 1921 he devoted his time chiefly to reporting on properties. Mr. Sharp has back of him twenty-four years of public utility experience, having started with the New York Edison Company in 1900, where he was first engaged in the meter department and later had charge of coal and boiler testing. In 1907 he went with the Des Moines (Iowa) Electric Light Company (then a subsidiary of the Electrical Securities Company, now a part of the Baehr interests) as general superintendent. Three years later he was made general superintendent of the Eastern Pennsylvania Railways Company at Pottsville, a J. G. White & Company property. He remained there two years, taking the position of general manager of the Helena (Mont.) Light & Railway Company in 1912 and remaining in that capacity until 1915. At the end of that period he became connected with A. E. Fitkin & Company as president of their properties, holding that position until his affiliation with the Middle West Utilities Company.

Obituary

Carl H. Nordfelt, a widely known engineer in the steam-turbine contract service department of the General Electric Company, died at Lynn, Mass., August 5. He was a native of Sweden, about fifty-four years of age, and had been with the company since 1912. In construction and repair work he had traveled extensively in the United States and foreign countries.

Henry Hopkins Lyon, assistant electrical engineer with the Buffalo General Electric Company, died on August 7 at his home in Buffalo as the result of a self-inflicted bullet wound. Before ending his own life Mr. Lyon shot to death his wife and two young sons. The cause of the tragedy has not been determined. Mr. Lyon was born in Buffalo in 1880 and was graduated from Cornell University in 1901. He was a member of the American Institute of Electrical Engineers and of the Engineering Society of Buffalo.

Robert E. Russell, manager of "Tungar" rectifier sales for the General Electric Company since 1922, died June 19. His first connection with the electrical industry was as a draftsman in the service of the Minneapolis General Electric Company. Later he joined the ranks of the General Electric Company at Schenectady, where he spent three years on test work. After a short period devoted to the development of rectifiers in the research laboratory, he took up commercial work in the supply department and in 1914 was made sales manager of battery-charging apparatus. Mr. Russell was a member of the American Institute of Electrical Engineers and of other associations connected with the electrical and automotive industries.

Arthur L. Kempster, vice-president and general manager of the New Orleans Public Service, Inc., and of its predecessor, the New Orleans Railway & Light Company, died July 28 following an illness of almost two years. Mr. Kempster had been identified with the New Orleans property since 1920, when he was engaged as general manager to study the traffic problem of the company, the lines at that time being in the hands of a receiver. A native of Canfield, Ill., he entered upon his career in the public utility field as an employee of the Seattle Consolidated Railway, subsequently becoming bookkeeper and auditor of the company. With the reorganization of the Seattle Consolidated as the Seattle Traction Company, Mr. Kempster became secretary and auditor, retaining these positions when the latter company became a part of the Seattle Electric Company's system. He remained with the Seattle properties until 1919, when the system was taken over by the city, Mr. Kempster then becoming traction manager of the railways of the city. One year later he was appointed general manager in New Orleans.

Financial and Corporate

Utility Market Dull

Flurries Appear, However, in American Power & Light and National Power & Light

MID-AUGUST dullness continued to characterize trading in the power and light equity markets during the past week, with the price changes representing a mixture of relatively unimportant gains and losses. It is still the season of year when least can be expected from the market in point of activity and when fluctuations of individual stocks are likely to overshadow general movements. And that is just what has happened during the past week. The general market has pursued no special course, having been rather irregular and quiet, but a few favorities have performed.

Among the star performers, American Power & Light common again must be mentioned in the most prominent line. Last week it touched 300 and in doing so aroused considerable interest. This week it moved to a fresh high at 337, a level that compares with a low this year of 200. While the enormous earnings of the company, which is one of the favorites in the Electric Bond & Share group, are what attract the investors to it primarily, rumors still are spread of a split-up in the shares sooner or later. Such a plan was followed in the case of American Gas & Electric, which was divided on a five-to-one basis, and the small units now sell around 75, or at 375 on the old basis. When such things are taken into account, of course, traders figure that American Power & Light at present levels still represents real value.

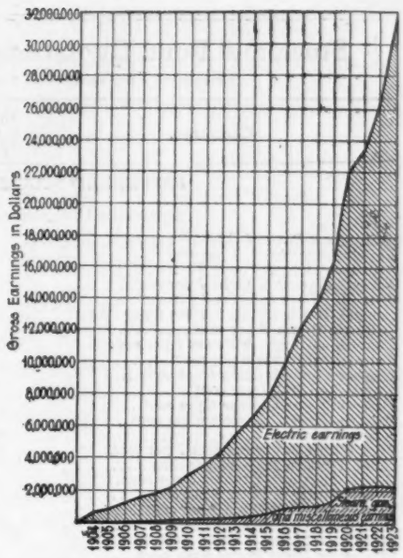
The other issue which attracted most attention during the week was, as it happens, one that belongs under the same supervisory group. It was National Power & Light common, a stock which sold earlier this year as low as 60, but which this week jumped to 148 before profit-taking sales drove it down again from that level. However, its net gain for the week was something like six points as against thirty-one for American Power & Light. National Power & Light is one of those companies which still is in the process of improvement and whose potential as well as present earnings play a part in the determination of values for the stock.

Detroit Edison Has Never Had Decrease in Annual Revenue

The Detroit Edison Company in beginning business in 1903 adopted the policy of providing a supply of electricity suitable for any probable use and available in any quantities which the communities served might require. This was indicated by its undertaking at once the construction of a power house more than three times as large as the aggregate of the plants which it found in operation. The result of this policy, continuously adhered to, has been very gratifying, as is shown by the accompanying diagram of gross earnings.

The 1923 report of the company shows satisfactory progress during the year, a healthy condition of business and property and good prospects for 1924. At the end of the year the company had a capitalization of $112,216,100, divided as follows: Capital stock outstanding, $43,405,900; mortgage bonds, $48,984,000, and convertible debenture bonds, $19,826,200. The gross revenue of the company for 1923 was $31,724,185, and the net income for the year was $5,147,551. A net addition of $14,337,478 was made to the fixed plant account as the result of additions to the generating, transmission and distribution systems of the company.

The output of the company during 1923 was 1,360,017,300 kw.-hr., an increase of 23.1 per cent over 1922. The maximum load of the year occurred on December 5 and was 303,600 kw. There never has been such a peak in the winter load of the Detroit Edison Company as exists in other cities. The load all day is little less than the occasional maximum, and the maximum arrives late in the year because business has been increasing all through the year.



ASCENDING SCALE OF DETROIT EDISON COMPANY'S EARNINGS OVER TWENTY YEARS

Public Service Corporation of New Jersey

How One of the World's Largest Utilities, Long Handicapped by an Antiquated Structure, Has Set Up a New Plan That Is Working Out Well

BY PAUL WILLARD GARRETT

A METAL band drawn about a young tree does not stop the rising sap, but it may stunt growth in the main trunk of the tree, cutting and weakening the structure. Many power and light companies nowadays are, in a sense, like growing trees. Large and small ones in recent years have operated under restrictions placed upon them in early days. To rid itself of an old handicap and open the way for a great and free growth, the Public Service Corporation of New Jersey recently has undergone a reorganization. The manner in which it has discarded an old-fashioned capital structure and substituted one that is modern and flexible marks an epoch in public utility history. The more so, of course, since the new plan has been put into effect without doing harm to any holders of the old securities.

Incorporated two decades ago, when its gross annual earnings aggregated about $17,000,000, the Public Service Corporation of New Jersey did not start with a structure permitting of unlimited growth. It was not supposed then that the business would, by steady yearly gains, grow to $80,000,000 by 1924. The old structure is worth analysis as a basis for understanding the new. Public Service Corporation of New Jersey was the structural head. Although it held many important leases of utilities in operation, it was primarily a holding corporation. Under it came the three main operating subsidiaries—(1) Public Service Electric Company, (2) Public Service Gas Company, and (3) Public Service Railway Company. The common stock of these subsidiaries was, of course, held by the parent corporation.

DEFECTS IN THE OLD SET-UP

When the fifty-million-dollar issue of general mortgage fives of 1959 was originally authorized, public utility financing was relatively a new science. The amount of the authorized issue was definitely limited and, unfortunately again, the bonds were made a direct obligation of Public Service Corporation of New Jersey secured by collateral rather than property. The operating companies were restricted in their right to issue bonds. The provision did three things that gave trouble and to correct which the new plan has been adopted.

First, it brought the corporation to a position, reached several years ago, when the authorized amount of $50,000,000 had been exhausted, where it had no instrument for the issuance of additional senior obligations to finance its future growth. To be sure, it still could sell junior securities, but no utility can live and finance itself exclusively and indefinitely by the sale of issues that bear high rates. Second, the plan prevented the issuance of bonds directly against the operating

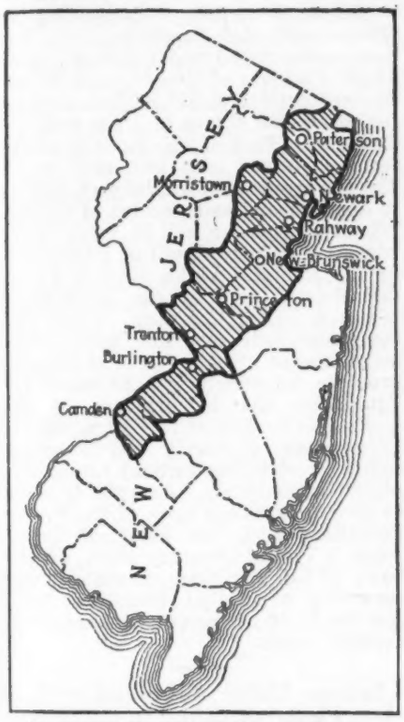
Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par value of stocks is $100.)

Companies	Bid Price Saturday, Aug. 9	Low 1924	High 1924
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	95	94	97½
Appalachian Power, 7 per cent	87½	85½	90
Arkansas Light & Power 7 per cent	90	81	93
Asheville Power & Light 7 per cent	96	96	99
Carolina Power & Light 7 per cent	97	95½	100
Central Illinois Public Service 6 per cent	84	84	87
Colorado Power 7 per cent	93	90	97
Connecticut Light & Power 7 per cent	99	99	102
Consumers' Power 6 per cent	89	85	93
Dayton Power & Light 6 per cent	84	84	90
Duquesne Light 7 per cent	105	103½	107½
Eastern Texas Electric 6 per cent	95	81	95
Empire District Electric 6 per cent	73	70	78
‡ Erie Lighting	*a* 28½	23½	30
Fort Worth Power & Light 7 per cent	97	97	100
Great Western Power 7 per cent	97	96	98
Illinois Northern Utilities 6 per cent	82	82	87
Illinois Power & Light 7 per cent	92	84	95
Kansas Gas & Electric 7 per cent	93	92	97
Long Island Light 7 per cent	98	95	98
Minnesota Power & Light 6 per cent	80	78	87
Mississippi River Power 6 per cent	87	80	90
Nebraska Power 7 per cent	96	89	99
Niagara Falls Power 7 per cent—25	27	27	29
Niagara, Lockport & Ont. Power 7 per cent	101	99½	104½
Northern States Power 7 per cent	94	91	97
Ohio Public Service 7 per cent	92	86	94½
Pacific Gas & Electric 6 per cent	90	85½	92½
Penn-Ohio Power & Light 7 per cent	91	84	96½
Pennsylvania Power & Light 7 per cent—no par	98	93	99
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	*a* 39	29	39
Southern California Edison 8 per cent	115	112	119
Tennessee Electric Power, 6 per cent	76½	71	79½
Texas Power & Light 7 per cent	95½	95	96½
Utah Power & Light 7 per cent	96	94	96½
Western States Gas & Electric 7 per cent	78	78	85
Yadkin River Power, 7 per cent	95	94	96½
Holding Companies			
American Gas & Electric 6 per cent—50	44½	41½	46
American Light & Traction	91	91	94½
American Power & Light 6 per cent	90	84	91
American Public Service 7 per cent	84	84	88
American Public Utilities 7 per cent	77	73	85
American Water Works & Electric 7 per cent	*a* 88½	66	99
Carolina Power & Light	98½	95½	99
Central Indiana Power 7 per cent	85	80	90
Cities Service 6 per cent	73½	67	75
Consolidated Gas 6 per cent—50	58	51	59
Continental Gas & Electric 7 per cent	85	69	90
Electric Bond & Share 6 per cent	100½	96½	103
General Gas & Electric 8 per cent—no par	101	96	101½
Middle West Utilities 6 per cent	87	80	90
National Power & Light 7 per cent—no par	91	84	96½
North American 6 per cent—50	49½	43½	50¼
Public Service Corp. of N. J. 7 per cent	97½	96½	100
Public Service Corp. of N. J. 8 per cent	106½	99½	108½
Standard Gas & Electric 8 per cent—50	49	46½	49½
‡United Gas Improvement—50	*a* 57½	55½	58
United Light & Power 6½ per cent—no par	78	75½	80
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	32½	22½	34
Appalachian Power—no par	73	66⅔	93
Arkansas Light & Power	47	22	50
Brooklyn Edison	*a* 115½	107½	116
Buffalo General Electric	145	118	150
Carolina Power & Light	145	82½	150
Colorado Power	33	21	35
Commonwealth Edison	126	126	135
§Consolidated Gas, Electric Light & Power	*a* 117	113	117
Dayton Power & Light	115	70	120
Detroit Edison	*a* 109½	102½	109½
|| Edison Electric Illuminating of Boston	*a* 184	163½	184
*Kentucky Hydro-Electric	87½	85½	87½
Long Island Lighting	150	100	185
Mississippi River Power	29	18½	31
Montana Power	65½	61½	71
Niagara Falls Power—no par	42	45	48
Niagara, Lockport & Ontario Power—100	53	45	59
Northern Ohio Electric—no par	10	5	16
Northern States Power	99	92	106
North Texas Electric	61	58	84
Pacific Gas & Electric	*a* 95½	90½	95½
‡Penn Central Light & Power—no par	60	57	60
Pennsylvania Water & Power	107	98½	110
‡Philadelphia Electric—25	*a* 39½	29	39½
Public Service Co. of Northern Illinois	97	97	104
Puget Sound Power & Light	59	43½	61½
Southern California Edison	98	95	106
Tampa Electric	155	134	160
Tennessee Electric Power—no par	35	20	40½
Virginia Power	45	16	60
Virginia Railway & Power	*a* 62½	36	72½
West Penn. Co.	*a* 89½	47½	98
Holding Companies			
‡American Electric Power—50	62	22½	62½
American Gas & Electric—no par	74½	43½	78½
American Light & Traction	128	115	140½
American Power & Light	330	220	330
American Public Utilities	77	35	80
American Water Works & Electric	*a* 113½	40	117½
Carolina Power & Light—no par	144	103	146
Cities Service	136½	140	155
Columbia Gas & Electric—no par	*a* 40	33	42⅜
Commonwealth Power Corp.—no par	91½	56	98
Consolidated Gas—no par	*a* 70⅜	60½	72⅜
Continental Gas & Electric	58	49	62
Federal Light and Traction	*a* 78	75	84
General Gas & Electric	51	22	55
Lehigh Power Securities—no par	75½	31	81½
Middle West Utilities—no par	56	41	60
National Power & Light—no par	132½	60	140
Philadelphia Co.—50	*a* 50	42½	53½
Power Securities—no par	10	4	14
Public Service Corp. of N. J.—no par	*a* 57⅜	39	58½
Standard Gas & Electric—50	36	27	37
United Gas & Electric (Conn.)—no par	33	14	42
Utah Securities	*a* 29⅜	16⅜	31½
BONDS			
Operating Companies			
Adirondack Power & Light 6s 1950	102½	97½	102½
Alabama Power 5s 1946	95½	90½	96
Appalachian Power 5s 1941	94½	89	94½
Brooklyn Edison 5s 1949	100¼	97½	102½
6s 1930	105	102½	106
7s 1930	107	105½	109
7s 1940	*a* 110	107	110
Central Indiana Power 6s 1947	93	88	95
Commonwealth Edison 5s 1943	99½	95	100
5s 1953	*a* 98½	92	99½
§Consol. Gas, Elec. Lt. & Pwr. 4½s 1935	*a* 95½	91½	95½
6s 1949	*a* 104½	101½	105
6½s 1951	*a* 108½	107	108½
Consumers' Power 5s 1936	98½	94½	99½
Duquesne Light 6s 1949	*a* 106	103½	106½
Great Western Power 5s 1946	94½	90½	96
Kansas City Power & Light 5s 1952	*a* 93½	89	95⅝
Mississippi River Power 5s 1951	96½	92	96½
New England Power 5s 1951	98½	97	100
Northern States Power 5s 1941	*a* 93½	89½	94
6s 1941	*a* 103½	96½	103½
Pennsylvania Water & Power 5s 1940	99	96	99½
‡Philadelphia Electric 5s 1966	*a* 101½	97	105½
5½s 1947	*a* 103½	99½	103½
5½s 1953	103½	98½	103½
6s 1941	*a* 106½	103½	106½
Southern California Edison 5s 1939	98½	96	99
6s 1944	102½	100	103½
Cleveland Electric Illuminating 5s 1939	99½	98½	100½
Detroit Edison 5s 1933	*a* 101	99¾	101
5s 1940	99¾	95	101
6s 1940	*a* 106	104	106½
Montana Power 5s 1943	*a* 97½	95	98
New York Edison 6½s 1941	*a* 112⅜	109¾	112⅜
Niagara Falls Power 6s 1950	*a* 106	104	106
Ohio Power 7s 1951	106	103	106½
Texas Power & Light 5s 1937	95	91½	95
Utah Power & Light 5s 1944	*a* 91½	87½	93½
Holding Companies			
Alabama Traction, Light & Power 5s 1962	78	65½	78
American Gas & Electric 6s 2014	94½	94	95½
American Power & Light 6s 2016	94½	91	94½
Amer. Water Works & Electric 5s 1934	*a* 93	84½	94
Commonwealth Power 6s 1948	*a* 96	87	96
Consolidated Cities Lt., Pwr. & Tr. 5s 1962	72½	64	73
Illinois Power & Light 6s 1953	99½	95	100½
United Light & Railways 5s 1932	92½	87½	92½
6s 1952	95¼	92	96
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	99½	90	99½
*National Carbon	*a* 122½	115	125
Worthington Pump & Machinery	*a* 78½	68	78½
COMMON STOCKS			
Allis-Chalmers Manufacturing	*a* 58½	41½	58½
American Bosch Magneto—no par	*a* 28	22½	38½
Electric Storage Battery—no par	*a* 58	50½	64
General Electric	*a* 273½	193½	281
General Electric—10	*a* 11¼	10½	11½
*Hurley Machine—no par	*a* 57	48	59½
Manhattan Electric Supply—no par	43¼	33½	49¼
*Vesta Battery—no par	15	15	28
†Wagner Electric	25½	23½	34½
Westinghouse Electric & Manufacturing—50	*a* 64½	55½	65
Worthington Pump & Machinery	*a* 26¼	23½	31½
BONDS			
Canada General Electric 6s 1942	*a* 106½	102½	106⅝
General Electric 3⅜s 1942	83	80	83
5s 1952	*a* 104½	100	104½
Robbins & Myers 7s 1952	77	75½	91½
†Wagner Electric Manufacturing 7s	100½	97	100½
Western Electric 5s 1944	*a* 98½	96	98⅝
Westinghouse Electric & Mfg. 7s 1931	*a* 109½	106½	109½

* Chicago Stock Exchange. † St. Louis Stock Exchange. ‡ Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange.
a Bid price Wednesday, Aug. 13.

properties. Third, the mortgage made it impossible for a lender to put his money into electric and gas department issues without involving a risk in the railways. Obligations of Public Service Corporation of New Jersey represented a risk in the whole enterprise. Troubles of the railway department, being injurious at different times to



TERRITORY SERVED BY PUBLIC SERVICE CORPORATION OF NEW JERSEY

public relations, tended to frighten some investors who had absolute confidence in the electric and gas departments.

These obstacles put pretty definite limitations upon the ability of the bankers to raise funds in sufficient amounts and at reasonable rates. Now Public Service Corporation of New Jersey by its new capital structure wipes out these antiquated features and opens the way for a great development.

FEATURES OF THE NEW PLAN

Under the plan now in operation, Public Service Corporation of New Jersey still stands, as formerly, at the head of the structure. But two of its former subsidiaries, Public Service Electric Company and Public Service Gas Company, and numerous lesser companies have been merged into one huge subsidiary. It is known as Public Service Electric & Gas Company. Through the Public Service Electric & Gas Company bonds now may be issued directly against the operating properties. Furthermore, there is no fixed authorized limitation, the amount being properly left, under conservative restrictions, to the needs for future growth. All in all, it represents a sounder basis for utility financing. Holders of the old Public Service Corporation of New Jersey general mortgage fives of 1959 are allowed to exchange their bonds for new Public Service Electric & Gas Company first and refunding five and one-halfs of 1959, an attractive switch. The old sevens of 1941 will be redeemed.

While the Public Service Railway Company has not been touched and bears the same relation to Public Service Corporation of New Jersey as before, investors now may put their funds into electric and gas bonds without incurring a railway risk. The new Public Service Electric & Gas Company, which is one of the largest of its kind in the world, will stand on its own feet. Its securities will not be materially affected by depression in the railway earnings. With an indicated annual business of $56,500,000, and with 1,090,000 customers, the new Public Service Electric & Gas Company represents a great and strong enterprise.

NEW ERA FOR PUBLIC SERVICE

The Public Service Corporation's general mortgage fives were available in the open market last January at 77, but, on improved earnings and the prospect for a new capital structure, the bonds have moved steadily forward to 105, a rise of 37 per cent so far this year. The common shares, under accumulation as a result of the new era that dawns for Public Service, have moved this year from a low of 39 to 58, a rise of 49 per cent. It is a testimonial to the improved credit position which a large utility may inspire, even within a short time, once it makes its financial structure shipshape.

Few New Sizable Issues During Past Week

During the past week new offerings of electric light and power securities were small in volume, the largest piece of financing being the five-million-dollar issue of gold debenture bonds of the American Power & Light Company offered at 94½ and accrued interest, to yield 6.35 per cent. The Standard Gas & Electric Company was represented with a $3,500,000 issue of preferred stock and the Indiana Hydro-Electric Power Company with a $1,500,000 issue of mortgage bonds. During the week there were offered 10,000 shares of the Middle West Utilities Company 7 per cent prior-lien stock at $97 per share and accrued dividend, to yield 7.22 per cent. With the purpose of providing funds for the cost of the recently acquired hydro-electric plant at Shawmut, on the Kennebec River, the Central Maine Power Company offered first and general mortgage 5½ per cent gold bonds to the amount of $1,550,000 at 99 and interest, yielding about 5.57 per cent.

Brazilian Company's Year

For the year ended December 31, 1923, the Brazilian Traction, Light & Power Company, Ltd., reports gross revenue for 1923 totaling (in Canadian currency) $6,717,941 as compared with $7,422,897 for 1922 and $4,410,057 for the year 1921. The surplus for the year 1923 amounted to $6,329,966 after interest charges, amortization, reserve and preferred dividends, equal to $5.82 a share earned on $106,581,000 ordinary stock. This compares with $6,251,968 or $5.86 a share in the previous year.

New Byllesby Holdings

Purchase of Sierra & San Francisco Power Company Will Form a Noteworthy Addition

THE purchase by H. M. Byllesby & Company, as foreshadowed in the issue for July 12, of the Sierra & San Francisco Power Company from the California Railway & Power Company marks a further expansion of the Byllesby interests in California. Not long ago the Byllesby organization acquired the property of the Coast Valleys Gas & Electric Company, with which the Sierra & San Francisco Company is connected in the Salinas Valley. By obtaining control of these two companies and tying them in with the lines of its other operating companies in California, the Byllesby company has taken effective means to meet the ever-increasing demands for adequate public service.

The Sierra & San Francisco Power Company owns water-power plants of 60,000 hp. capacity on the Stanislaus River in Tuolumne County, 140 miles from San Francisco, and a high-voltage transmission system aggregating 850 miles. The company is at present operated under lease by the Pacific Gas & Electric Company and is connected with the Western Gas & Electric Company near Stockton as well as with the Coast Valleys Gas & Electric Company. The company's lines traverse thirteen counties in central California, serving a large agricultural and industrial territory. The company owns a number of undeveloped water-power sites on the Stanislaus and Tuolumne Rivers and owns and operates the water supply of

STANDARD GAS & ELECTRIC COMPANY'S CALIFORNIA SYSTEMS

a large irrigation district. In acquiring the Coast Valleys Gas & Electric Company the Byllesby company added to its system a transmission and distribution system totaling 380 miles and serving the farming, dairying and fruit-growing districts of the Salinas Valley and the Monterey peninsula, two of the

earliest settled parts of California. Growth of business and the improved conditions during 1923 resulted in an increase of 18.6 per cent in the gross revenue of the company, and additional new business is anticipated for the current year to take care of which a considerable amount of construction has been authorized.

The figures contained in the annual reports for 1923 of the other public utility companies in California operated by the Standard Gas & Electric Company reflect successful management and efficient operation. The Western States Gas & Electric Company reported an increased gross revenue of 10.7 per cent over the preceding year and an increase of 10 per cent in the output of electrical energy. The San Diego Consolidated Gas & Electric Company showed increased gross earnings of 0.8 per cent and net earnings of 19.8 per cent in 1923, the net earnings being favorably affected by a marked decrease in operating expenses. The investment required for new construction, additions and improvements was $3,322,433, and during the year the company gained 4,572 electric customers.

Dividends Declared

The following quarterly dividends were announced by central-station companies during the seven-day period ended August 12:

Name of Company	Per Cent	When Payable
Central Arkansas Ry. & Lt., pf.	1¾	Sept. 2
Central Mississippi Valley Electric Properties, pf.	$1.50	Sept. 2
Dominion Power & Transmission	1	Sept. 15
Duquesne Light, 1st. pf., series A	1¾	Sept. 15
Federal Light & Traction, com.	1	Sept. 15
Federal Light & Traction, com.* (extra)	75c.	Sept. 15
Federal Light & Traction, pf.	1¾	Aug. 30
Kentucky Hydro Electric, pf.	$1.75	Sept. 20
Kentucky Utilities, 7 per cent junior pf.	1¾	Aug. 20
Los Angeles Gas & Electric, pf.	1¾	Aug. 15
Nebraska Power, pf.	1¾	Sept. 1
Pacific Gas & Electric, pf.	$1.50	Aug. 15
Southern California Edison	2	Aug. 15

* Payable in preferred stock.

Company Reports

Among the company reports issued during the past week for the month of June are the following:

Name of Company	Gross Revenue for June 1924	1923
Barcelona Traction, Light & Power	$4,452,601	$3,711,837
Binghamton Light, Heat & Power	102,446	87,443
Eastern Shore Gas & Elec.	47,874	44,666
Federal Light & Traction	417,146	423,057
Manila Electric*	303,994	298,268
Metropolitan Edison	632,039	609,688
New Jersey Power & Light	80,487	75,011
Northwestern Ohio Railway & Power	41,618	48,601
Pennsylvania Edison	238,365	235,732
Pine Bluff	75,071	71,113
Reading Transit & Light	243,338	263,424
Rutland Ry., Lt. & Pwr.	40,516	40,988
Sandusky Gas & Electric	65,029	62,869
Sayre Electric	16,062	15,099
Sierra Pacific Electric	90,450	86,385
Vermont Hydro.-Electric	54,582	56,192
American Tel. & Tel.	5,927,944	5,900,115

* July

Manhattan Electric Report. — Net profit of the Manhattan Electric Supply Company for the first six months of 1924 was $111,373, equivalent to $1.59 a share earned on the outstanding 70,000 shares of no-par-value capital stock.

Power Company Increases Capital Stock.—The St. Lawrence Valley Power Corporation, Potsdam, N. Y., has filed a certificate in the office of the Secretary of State increasing its capital stock from $5,750,000 to $10,000,000.

Heavy Construction Program in Tennessee.—The results of a survey conducted by the Tennessee Public Utilities Commission indicate that expenditures for new construction in this state during 1923 and 1924 will probably total more than $15,000,000. Practically all the money will be used for hydro-electric development.

First Customer-Ownership Campaign Nets Ten Million Dollars.—The Cleveland Electric Illuminating Company in its first customer-ownership campaign, just ended, sold at par 6 per cent preferred stock amounting to $10,000,000 to 6,500 stockholders. Employees of the company sold more than $800,000 worth of the stock.

Mississippi Utility to Purchase Additional Properties. — The Mississippi Power Company is negotiating for the purchase of a number of public utility properties in Mississippi, according to J. M. Barry, vice-president and general manager of the company. If the properties are acquired, they will, it is announced, be served from the system of the Alabama Power Company.

Durham Company Bonds Called.—The Durham (N. C.) Public Service Company has called all of the outstanding general mortgage sinking-fund gold bonds, series A, dated April 1, 1921, for payment October 1 at 102 and interest.

Wisconsin Utility Plans Consolidation.—The Interstate Power Company of Lancaster, Wis., has been authorized by the Railroad Commission of Wisconsin to issue $10,000,000 in securities as the first step in the consolidation of a dozen or more electric light and power plants operated by the company in western Wisconsin, northeastern Iowa and southern Minnesota, which furnish light and power service to consumers in nearly sixty cities and towns in these three states. This step was taken, it is reported, in order to effect a saving of approximately $225,000 through consolidating the companies into one working unit which will facilitate the work of handling electric service in the communities served.

Savannah Company Plans Employee-Customer Stock Issue.—A special meeting of stockholders of the Savannah Electric & Power Company has been called at Savannah, Ga., for August 29 to secure authorization of an increase in first preferred stock from $4,800,000 to $5,300,000. The increase will be known as series B and will be entitled to cumulative dividends at the rate of 7½ per cent per annum. On approval of this issue $250,000 of the new stock will be offered on sale in Savannah to employees and customers of the company at par. The proceeds will be used to retire bank indebtedness of $185,000 and for other purposes as required. Transfer books closed August 15 to 29 inclusive. The total authorized stock of the company is $4,800,000, all outstanding, and the dividend rate on the series A first preferred stock is 8 per cent. Series A is redeemable at $125 and series B is scheduled for redemption at $110 per share. Stone & Webster, Inc., Boston, are managers of the company.

United Securities Incorporated in Quebec. — United Securities, Ltd., has been incorporated under letters patent of the Province of Quebec, with an authorized capital of $20,000,000, consisting of 200,000 shares of a par value of $100 each. Part of this issue is in the form of 6 per cent preferred stock. The preferred stock will be preferred as to dividend and as to return of capital. Effective provision will be made under which such dividend will be guaranteed by the Montreal Light, Heat & Power Consolidated and by the Shawinigan Water & Power Company. These two companies will subscribe for a very large amount of both stocks at par, the proceeds of which will be used for liquidating the indebtedness of the Quebec-New England Hydro-Electric Corporation (formerly the Montreal Public Service Corporation) falling due almost immediately. An offer is made to give in exchange stock of the United Securities, Ltd., for Montreal Tramways & Power Company stock, on the basis of $15 per share, payable in the securities of United Securities, Ltd., payable $7.50 preferred stock and $7.50 common stock.

Indiana Utility Authorized to Purchase Plant.—Authority to the Indiana Hydro-Electric Company to buy the electric generating plant of the Interstate Public Service Company at Monticello, Ind., and then to issue securities, the major part of which will be used to construct a hydro-electric plant at Oakdale, 10 miles south of Monticello, has been granted by the Public Service Commission. The present plant is on the Tippecanoe River and the new plant, as already announced, will be on that river also. The sale price of the present plant will be $250,000 cash. The Indiana company will issue $1,750,500 of 6 per cent first gold mortgage bonds and $437,600 of preferred stock, each issue to be at 85 per cent of par. After using money for payment to the Interstate, the Indiana company will be required under the order to turn the remainder of the proceeds of the bond issue over to a trustee. It will not have the use of this money, then, until it actually has expended money on the new hydro-electric plant and has filed a certificate with the trustee showing progress in the construction. The order said that the Interstate Public Service Company could use the $250,000 which it receives for the Monticello plant to discharge that amount at par of its outstanding securities, or could use it to pay for betterments made or to be made, or for the reimbursement of its treasury of $250,000 for capital expenditures. It was specified that if the Interstate used the money for any one of the last three uses—not for discharging that amount of its outstanding securities—no securities should be issued for such purpose in the future.

Commission Rulings

Enforced Extensions Must Be Reasonable.—In ordering the Coast Gas Company to extend its service upon the deposit with or tender to it of a stated amount, the New Jersey Board of Public Utility Commissioners said that a franchise ordinance granting a utility the right to sell and to furnish such service as may be required in a borough should be construed as requiring service when and where it might be reasonably required and in conformity with the law, rather than requiring extensions in the borough wherever called for or however unreasonable or unnecessary and also in possible conflict with law and the authority of the Public Utilities Board.

When Is Unprofitable Service a Duty?—In a case affecting the Virginia Railway & Power Company the Virginia State Corporation Commission held that the mere acceptance of a public service charter did not impose an absolute duty on a company to perform continuously certain duties regardless of profit. A public service corporation, the commission said, is a private enterprise and has a private legal entity and rights as such and the stockholders have rights and are entitled to consideration. The opinion continues: "The mere fact that the operation of a part of a large enterprise is not at a particular time profitable will not of itself alone justify a discontinuance or abandonment of such branch of the larger activity. However, where there is coupled with operation at a loss at a particular time the absence of reasonable prospect of improvement within a reasonable time in the future—that is to say, where it appears that the prospects are that continued operation under all circumstances would continue for an indefinite length of time to be at a loss—a discontinuance is justified, since a compulsory conduct of operation would amount to a confiscation of private property."

No Return Allowable Upon Excess Purchase Price.—Dealing with the acquisition of certain properties and franchises by the North Missouri Power Company of Excelsior Springs, Mo., the Missouri Public Service Commission said: "(1) It is proper and equitable that some compensation be awarded holders of franchises and investors supplying small communities with electrical conveniences. (2) The commission should not arbitrarily interfere with the transfer of these properties, nor intervene as to the price paid by parties competent to contract who desire to pay excess prices for what they purchase, or deny to the seller the benefit of his contract; and its chief function is the exercise of its lawful power to cause good service and reasonable rates to be given to the public so that efficient service will be rendered by the utility and a fair and reasonable return be made the investor in the rate authorized for this service. (3) However, purchasers of these plants paying an excessive value should not be allowed to charge this excess to plant account, nor should they be allowed as against the public, in a valuation of the system, a return upon these excess investments. Therefore, it is the conclusion that in approving the sale as petitioned by the applicant, it will require that applicant shall charge off of its plant account the sum of $2,076.93, so that same may not be carried therein at the purchase price of $3,000."

Application for Certificate Where Utility Meant to Purchase Power and Export It from State Disapproved.—The Illinois Utility Corporation applied to the Commerce Commission for a certificate of convenience and necessity, the company's intention being to purchase a short transmission line at New Boston, on the Mississippi, connect it to the lines of the Illinois Northern Utilities Company and buy power from the latter for export across the river to Iowa. The application was dismissed as obviously not in line with the proper functions of the Illinois commission.

Recent Court Decisions

Commission's Power to Fix Rates Notwithstanding Agreement Between City and Company.—Discussing a bill brought by the city of Attalla against the Alabama Water Company to enforce a contract, the Supreme Court of Alabama said that the police power of the state could not be abridged or suspended by such a contract and that the Public Service Commission was empowered to fix rates to be charged by the company, notwithstanding an existing lease between city and company fixing rates, since the city had no power by such lease to deprive the Legislature or its agent, the Public Service Commission, of the exclusive constitutional jurisdiction to fix rates. (100 So. 491.)*

One Electrocuted in Neighbor's Garage Held to Be an Invitee.—Solomon vs. Moberly Light & Power Company was a suit for damages because of the death of plaintiff's husband, an electrician, who had been called into a neighbor's garage to help care for a brother of the owner found there unconscious, and who on subsequently seeking for the cause of the other's injury was alleged to have come into contact with high-voltage current entering the garage over the company's wires and to have himself been killed in consequence. The company claimed that the man was guilty of contributory negligence and had no right to be meddling with the electrical equipment on another's premises. The Supreme Court of Missouri affirmed a verdict for $10,000, holding that the deceased was an invitee in the garage, entitled to protection, and that the questions of contributory negligence and of whether or not the wires carried excessive voltage were properly submitted to the jury. (262 S. W. 367.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Police Power of State Supersedes Franchise Grants.—A decision of the Supreme Court of Missouri in City of Cape Girardeau vs. St. Louis & San Francisco Railroad ruled that franchise grants by a city to public utilities cannot impose permanent conditional regulations on the cities or upon the public utilities when such conditions are incompatible with the general welfare. "Neither the state nor any of its agencies (cities, towns or villages)," declared the court, "has, or ever has had, the power to contract away the police power of the state, and franchises granted or ordinances passed by cities affecting subjects coming within the power of the state must be considered as having been granted or passed with reference to the power of the state, in the exercise of its police power, to legislate with respect to such matters and subjects, unfettered by the provisions of such franchises and ordinances. . . . Economical and efficient operation of public utilities would be impossible unless the state or its delegated agencies have the power, under the police power of the state, to say that further performance of such provision of the franchise is incompatible with the general welfare. . . . The ordinance provisions cannot control the action of the Public Service Commission in the face of the general welfare."

Award of Damages Against Company for Shutting Off Energy to Pumping Station During Fire Sustained.—The suit of the Highway Trailer Company of Edgerton, Wis., against the Janesville Electric Company for damages because of alleged negligence in shutting off the supply of energy to the municipal pumping station during a fire at the company's plant, which has been in the Wisconsin courts since July, 1921, has again been tried in the Circuit Court of Rock County and a previous verdict of $47,703, rendered by a jury, affirmed. (See ELECTRICAL WORLD, December 23, 1922, page 1411, and May 3, 1924, page 905.) In rendering its verdict the court declared the case to be an unusual and perplexing one. The electric company contended that if it was negligent, then the action should be for breach of contract between the city of Edgerton and the company, since the latter was under contract to supply the city with electric power. If such a breach existed, under Wisconsin law an individual who sustained losses would be remediless to recoup them, the company asserted. The court held that such a breach probably did exist, but that culpability of the electric company extended further, that it owed a duty to society and to every individual to whom it furnished light and power, and that since destruction of the plant had been rendered easier through lack of water the electric company was responsible.

Manufacturing and Markets

England Five Years After the Peace

A Letter from the Former Editor of the "Engineering News-Record," Now Traveling in Europe Studying the Industrial and Business Situation

By E. J. Mehren
Vice-President McGraw-Hill Company

THE war is past history in America, but current history in Great Britain.

So, indeed, it seems after spending a week in Britain's capital, conversing with her men of affairs and listening to addresses by her business leaders and statesmen. True, there are war scars in the United States, scars that will never be erased. We are mindful of the men who died in the great struggle; we have great numbers of disabled veterans. On the financial side we still have, and will have for many years, a war-swollen budget and correspondingly increased income taxes. But, by and large, the war shadow his thinned out. In the last two years we have had "good times." Our war-time income tax rates have been twice reduced. Certainly the way is not blocked by serious obstacles. The difficulties we foresee are merely the fluctations which, except for the "panic years," one might say are normal to business.

Not so with Britain. The war is only a yesterday with her, and the consequences are still sharp upon her. I do not mean that she is discouraged; that word has no place in the British vocabulary, nor has the state of mind it indicates any place in British consciousness. But the burdens that weigh her, the obstacles still to be overcome, are fully appreciated and are a stock subject of discussion with all her thinking men.

British Problems

To enumerate some of the troubling factors:

1. There is still a large shortage of employment, though the amount is lessening.

2. There is marked depression in the "engineering trades," as they are called in England — ship-building, machine-tool building and the metal-fabricating industries generally. In construction there are few large projects in hand, though there are a few that, after long delay, now seem likely to be taken in hand.

3. A new housing bill, that will again dip heavily into the national and local government treasuries—and increase, accordingly, national and local tax burdens — is before Parliament.

4. The income-tax rate on even small incomes is 4 shillings 6 pence per pound sterling, or 22½ per cent. The supertaxes are very heavy.

5. The "Continental problem" is acute, and the consequent uncertainty, the upset exchanges, the diminished purchasing power, curtail British export markets.

6. Finally, the never-ending exchange of views with their Continental war allies on German reparations keeps before the British people constantly the fact that peace, though declared five years ago, is not yet here. There is cessation of military activity; there is not that accord which is peace in actuality.

That the consciousness of the international element in these difficulties is ever present with the thinking Britisher was strikingly demonstrated at the great advertising convention held here, at the British Empire Exhibition. There were delegates from every country, though the United States sent the largest representation—1,700, including the women. To this great convention man after man emphasized the distressed position of Europe and expressed the hope that out of the international discussions now under way in London and participated in by the United States there may come that peaceful adjustment for which Europe has been longing since that wonderful November 11, 1918. Winston Churchill, Sir Robert Horne, J. H. Thomas, Colonial Secretary, and Lord Burnham, in particular, made this an important feature of their addresses. Every other speaker from the British Isles made some reference to the unfortunate international situation and its effect on British industry, on British trade and on British social and political conditions.

Social Conditions

In private conversation one gets an even more serious picture of England's difficulties, for there the talk turns to social conditions. Briefly, the burden of these conversations can be reduced to just this: that the altruistic promises of war times and the coddling by politicians have taken from the mass of British workers a sense of responsibility for their own welfare and led them to expect the government to take care of them. Thrice, indeed, was the statement made to me, and in separate conversations, that there was a growing opinion, fostered by socialist agitators and politicians, that if the people would have the babies the government would do all else. Such an attitude, of course, leads, and has led, to shiftlessness, inefficiency when at work, failure to provide for the rainy day—in a word, all of the economic vices that curse any people who allow themselves to become dependent and spineless.

The worst of the difficulty is that no one with whom I have spoken about this attitude of the people seems to have any hope for early improvement. The politician—not the statesman—is the ruler of the day, and, as with us, he does not hesitate to sell the public treasury in order to advance his personal interests.

Britain's Attitude

Withal, though, it should be repeated, that the Englishman is not discouraged. He has lived through a lot. He hopes that he will live through this trying period and that a better day will come.

His way is not our way. We would think that his more or less complacent attitude might be fatal. He believes that the situation will turn out all right; we would fear that it would turn out all wrong unless vigorously handled. (One recalls our unemployment conference of

some years ago.) We, I hope, would turn, as long as possible, to private measures of relief. The British have turned to the government. The difficulties, of course, were very great; the amount of unemployment, as already said, quite large. Possibly with similar conditions we would have been forced to a similar solution, but I am inclined to believe that the British tap the national treasury with less hesitation than we. The actual war, let us recall in possible explanation, lasted twice as long for them as for us.

But though our methods might differ from those of the British, we cannot withhold our admiration of their sterling qualities. Similar conditions would put us in a panicky condition. They go on hanging out their sign, "Business as usual," confident that eventually all will be well. Looking back on their long and brilliant history, we too, can feel confident that somehow the Briton will come out on top. Trial and difficulty develop stamina and character. They are developing them right now in business circles. In the wage-earning classes the tendency is in the opposite direction. Eventually, under the example of conscientious leaders, even that tide should change.

Selling at a Profit

Tampering with Price Demoralizes Salesmen, and the Buyer Usually Gets No Benefit—The Industry Suffers Always

BY A MANUFACTURER

IT IS generally admitted that a profit must be made on every article sold. Selling at a profit is naturally the aim of every electrical manufacturer, jobber and dealer. But it seems doubtful whether it stands out sufficiently in the minds of business men of the electrical industry; for whenever the legitimate price of an article is tampered with to obtain advertising value, to keep the other fellow from getting the business, or "to get a look in," then selling for a profit is not being seriously regarded.

The only way to sell at a profit is to sell the material at a legitimate price. This means that the normal profit is included. But selling at something below the legitimate price is commonly resorted to, and the reasons advanced to justify this are many. I have an idea that if the same amount of time that is spent in thinking up reasons to justify quoting something below the legitimate price were put on thinking of ways to sell at legitimate prices we should all be better off. Certainly the purchaser would be better off, because at least in most instances he pays in one way or another for the lower price obtained. If not directly, he pays indirectly.

Salesmen are as concerned as any one else with the question of selling at a profit. But a salesman is a human being, and if the management does not understand selling at a profit and insist upon it, naturally the salesman will not. In fact, one of the unfortunate results of tampering with legitimate prices is the demoralizing effect that it has on an organization's personnel, a large portion of which must be considered to be in training and to be the business men of tomorrow.

A TYPICAL CASE

A concrete instance of an attempt just to make a sale without regard to its profit possibilities recently came to my attention. A firm had on hand some staple products which are quoted on the market at standard prices both at wholesale and retail. An inquiry for this material was received, and as there was a certain amount of depreciation on account of the goods having remained on hand, the firm figured to make a profit by reducing the loss and therefore quoted a close price. Another firm in the same line of business, but not having any of the material on hand, quoted the current prices, which would yield a legitimate profit. I presume that there were other bidders, but at any rate the concern quoting the legitimate prices learned of the lower quotation and immediately reduced its prices slightly below those of the first concern and was awarded the business. The firm took the loss in order to involve another in a greater loss. Certainly, there was no question of profit involved, and the result of the whole transaction was detrimental to the industry. It is true, of course, that the purchaser did obtain some material at below the market price, but whether he made a gain because of another's loss is very questionable. Incidentally, also, the training which the salesman received in handling the second proposition certainly will not fit him for selling at a profit.

SUPPLIER ALONE RESPONSIBLE

The average purchaser does not desire to buy at a price which means a loss to the supplier, but certainly no one can criticise him for getting the lowest price offered consistent with the usual limitations. Whether or not the purchaser buys at prices which involve a loss to the supplier is absolutely up to the supplier and no one else. No one objects to paying a legitimate price, but the supplier must sell at legitimate prices if the buyer is to buy at such prices. The supplier does not sell at a legitimate price, however, unless he is selling at a profit and is in position to give full quality in the material and the service that the buyer desires and expects and that a legitimate profit should justify.

Changes in Norwegian Duties on Cable and Insulators

THE basic duties of the Norwegian import tariff have been changed on electric cables and insulators, according to a cablegram received at the Department of Commerce from Harry Sorenson, acting commercial attaché, Copenhagen. The extraordinary surtax of 33⅓ per cent of the basic duties on these products, as well as the gold surtax (at present 90 per cent), remains unchanged.

Lead-covered electric cables, which were formerly free of duty, now have a tax imposed of 0.10 crown per kilogram, while other electric cables, which formerly were free of duty or carried a duty of 0.50 crown per kilogram, according to classification, now carry a uniform duty of 0.35 crown per kilogram. Porcelain insulators for high-tension current have had the duty reduced from 0.55 crown per kilogram to 0.35 crown per kilogram, while the duty on porcelain insulators for low-tension current remains the same, 0.25 crown per kilogram, as well as the duty on other porcelain insulators, which also remains at 0.06 crown per kilogram. It is to be further noted that the customs authorities may always fix a duty of 0.06 crown per kilogram on insulators of a kind not manufactured in the country.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

ALTHOUGH the improvement in the business situation has extended over several weeks, no marked increase in orders is yet apparent, but undoubtedly the strong optimistic note struck by electrical men is even more pronounced at this time. It is encouraging to observe that the tendency is for prices to hold firmer. Copper has continued its upward advance along with the other non-ferrous metals, and should this activity continue further copper wire and other copper products will again advance. Recent advances have created a temporarily active market for copper wire.

Prospects of heavy crops in the Southeast and Middle West still further lend an optimistic tone to the business situation, and increasing activity is noticeable on the part of textile mills. In addition, there is an abundance of credit as the Federal Reserve bank now shows an 83 per cent reserve, which is far above the 40 per cent margin of safety provided by law. This is explained by the fact that the banks are so well provided with funds that they do not need to rediscount their loans.

Central-station expansion continues to exert a steadying power in the New England trade, and conditions are improving in the textile field. In the New York district business continues to show a small improvement. Radio sales in this district are up well in certain lines. Good prospects for heavy crops in the Southeast improve the outlook, fans are moving briskly and building permits are continuing to increase. In the Middle West utilities are purchasing heavily and buying in general remains brisk. A conference of silver-mining interests held in Salt Lake City last week has resulted in definite steps toward a successful solution of problems important to the welfare of that industry. On the Pacific Coast power company business has improved over last month and many inquiries are being received from lumber mills as well as from some agricultural sections.

Price Reductions Made on Poles Vary from 10 to 20 per Cent

EFFECTIVE at once, the Naugle Pole & Tie Company, the National Pole Company and the Page & Hill Company have made substantial reductions in the price of their complete line of Western red and Northern white cedar poles varying from 10 per cent to 20 per cent. This reduction affects the flat price of the poles, including the cost of the pole, freight and creosoting.

The following statement was made by W. C. Frontenson, sales manager of the Naugle Pole & Tie Company, to a representative of the ELECTRICAL WORLD: "The lowering of prices is done with the view of increasing sales, still keeping the idea of a quantity as well as a quality business. This reduction does not curtail any of the pole or treating service now rendered by the company. We have been putting in large stocks of poles in our yards, being certain that a large demand will begin in September. With this in mind, we have just completed a large treating plant at Pinconning, Mich., which, added to the available capacity in Chicago, will give us an ownership of 2,500 sq.ft. of treating capacity."

It is likely that other companies may make similar announcements shortly as distributors have generally stocked up their concentrating yards in the East during the low-buying period of the past few months, and the price reductions now announced is intended to start some of this stock moving.

Non-Ferrous Metals Continue to Advance in Price

PRICES of non-ferrous metals have continued to advance. Large amounts of lead have been purchased during the week as well as moderate quantities of copper and zinc, and buying of tin has been good. There appears to be more speculation in copper and tin than in any of the other metals. Copper has advanced another quarter cent, making the price 13⅝ cents delivered, but several producers are asking 13¾ cents. Many export orders have been received, Germany being an especially active purchaser. The steadiness of the London market and the improvement in the value of the pound sterling have been important factors in helping the market to rise.

NEW YORK METAL MARKET PRICES

	Aug. 6, 1924 Cents per Pound	Aug. 13, 1924 Cents per Pound
Copper, electrolytic	13⅛	13⅜
Lead, Am. S. & R. price	7⅛	7⅛
Antimony	8¼	9¼
Nickel, ingot	27	27
Zinc, spot	6.175	6.20
Tin, straits	52	51⅜
Aluminum, 98 to 99 per cent	28	28

The American Smelting & Refining Company advanced its official contract price of lead from 7.50 cents per pound to 7.75 cents per pound on Monday. Large quantities of lead have been purchased by all classes of buyers with the exception of the storage-battery makers, yet the demand appears to be still unsatisfied.

Sales of zinc have been larger than usual during the week, the metal being mainly purchased by galvanizers for prompt shipment or delivery in August. Although the price declined to 6.05 cents the latter part of last week, it has since risen steadily to 6.20 cents.

Domestic consumers of tin made very good purchases, so that the price advanced responsively to 52⅛ cents, although a slight recession occurred since.

Industrial Buying Improves in New York District

BUSINESS in the New York district continues to show a small improvement, particularly in the case of industrial buying and supply merchandise, and plenty of orders are being received, although the volume of individual orders is small. Several important projects are reported as pending, and the strong optimistic note expressed by electrical men is even more pronounced at this time. The fact that prices are holding firmer and there is less of a tendency for them to waver is considered the most encouraging sign of an improvement.

The hot weather continuing last week served to help move fans from the dealers' and jobbers' shelves, but the movement was not sufficient to create reorders from the manufacturers. Appliances are moving slowly, although some large curling-iron orders were received. Radio sales have kept up very well indeed in certain lines and deliveries are now being made promptly. Copper wire again increased in price early this week in tune with the rising copper market. The result has been to create a temporarily active market which, should it continue, will soon result in delayed deliveries.

Buying by Utilities the Flywheel of New England Trade

CENTRAL - STATION expansion continues to exert immense steadying power in the New England electrical trade. Industrial-plant buying is still quiet, but improving conditions in the textile field have begun to brighten the economic situation in scattered localities. Much important industrial electric heating work is in process, and plans for establishing better standards of lighting in the home and in business houses are taking effective form. Electric appliances are moving well and gratifying purchases by visitors to a recently opened electric show at Hampton Beach, N. H., are reported.

The home-building industry is marking time and contractor-dealers are chiefly occupied with small jobs. Last week's hot weather drew a few fans out of retail stocks, but on the whole the fan season has been a very poor one in New England. Prices have been sluggish this month, although wire has stiffened slightly on later quotations, and reductions on radio tubes and "B" batteries have been followed by a strengthening demand, which appears, however, to be mainly the inception of a pre-seasonal revival in interest.

More Activity in Southeast—Crop Prospects Very Good

HOT weather continues to improve the prospects for a heavy cotton crop, while other crops, particularly tobacco, are above the average. These conditions have served to lend an optimistic tone to virtually all lines of

business. July building permits in nine Southeastern states were 2 per cent in excess of June and 41 per cent over July last year. The total value of contracts awarded in these states during the first seven months of 1924 amounted to $356,591,100, a 17 per cent increase over the same period of 1923. The textile mills are showing an increased activity and a number of satisfactory electrical jobs have been closed in the past ten days, with an unusual number of inquiries in hand. Stone quarries and marble-finishing plants that are prosperous as a result of building activities are also satisfactory purchasers of electrical apparatus.

Jobbers' sales to retailers are slightly off, though the sales of dry batteries are above the volume for this time last year. Fans continue to move briskly, but ranges are showing a tendency to slow up somewhat. The larger jobbers are beginning to place orders, which are considerably above the average, for fall stocks. Orders for radio equipment and holiday goods are particularly strong.

Trade in Middle West Continuing Upward Movement

ELECTRICAL buying in the Middle Western district remains brisk. The feeling of optimism accelerates purchasing and the cautiousness so noticeable previously is now somewhat abating. However, the trade is still reluctant to place large commitments. Competition is desired and is extremely keen on most commodities. The utilities are buying larger quantities of material, although expenditures are still being very closely watched. The principal items purchased this week were meters and high-tension equipment. One order for repair parts to turbines was of considerable size. Sizable orders for high-tension equipment were placed, and a considerable amount of pole-line hardware and underground material was also purchased.

Prices have remained practically the same, although the price trend of most commodities is upward. Following the increase on code wire last week, flexible armored conductor advanced $3 per 1,000 ft. Appliance sales have been good, with washing machines considerably in the lead, one manufacturer reporting a single order for more than 500 machines. Hot weather has moved a good volume of fans. Industrial-heating sales have increased somewhat through the hotel and restaurant trade.

Salt Lake City Silver-Mining Interests Hold Conference

A CONFERENCE of silver-mining interests concluded in Salt Lake City last week resulted in definite steps toward the successful solution of problems highly important to the welfare of the section as silver mining is one of the most important industries. Electrical jobbers report a substantial increase in business as compared with the same period last year, and the outlook is considered as very satisfactory for future favorable conditions. Summer quietness prevails in many lines, but building activity is keeping up and stimulating the movement of construction material.

Good Power Company Business on Pacific Coast

POWER company business on the Pacific Coast is showing a good increase for the month of August as compared with July, during which month purchases were largely for maintenance. An inquiry for 10,000 cross-arm braces is reported, with other hardware orders on the same scale, although poles and insulators are temporarily not in very good demand. Railroad business has shown some improvement over its July slump.

Rubber-covered wire, boxes, receptacles and dry batteries are recording good sales. The Radio Show opening August 16 is expected to produce very good results. Some good electric range sales are reported, largely to the district offices of power companies for display purposes. This is encouraging because it proves that there is no intention of losing the effect of the missionary and sales work of the past few years, even though circumstances temporarily prevent its continuation on the same scale.

Seattle jobbers report numerous inquiries for large motors for lumber-mill installations, also from the agricultural sections for farm-lighting plants. The inquiries are expected to develop into orders following further stiffening of lumber prices and sale of crops. The lumber market has been improving and prices trending upward following months of depression, so that at present orders are in excess of production and lumber mills which closed down prior to the fourth of July are slowly resuming work. This also applies to logging camps in the Puget Sound district. Prices throughout the coast section are firm.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Westinghouse Ships Surface Condensers to California

Two 55,000-sq.ft. radial-flow surface condensers and the necessary auxiliaries are now being shipped by the Westinghouse Electric & Manufacturing Company to the Southern California Edison Company. These condensers will be the largest installed west of the Mississippi River. Condensing water will be supplied to each of the condensers by two 35,000-gal.-per-minute circulating pumps driven by variable-speed motors. Each condenser will be equipped with two motor-driven steam air ejectors, one pump and one ejector unit being for standby service. These condensers will serve two 35,000-kw. turbines.

The Westinghouse company has also received an order from the Brooklyn Edison Company for a 6,000-kva. turbo-generator unit and a 4,000-sq.ft. surface condenser to be installed in the new Hudson Avenue station, Brooklyn. The unit is to be used as a house turbine.

Changes in De Laval Steam Turbine Sales Represntation

The Wm. Constable Company, Duluth, Minn., will henceforth represent the De Laval Steam Turbine Company, of Trenton, N. J., having purchased the H. J. Rich Company, the former representative in that district. The territory covered by the Wm. Constable Company includes parts of Minnesota, Wisconsin and the entire northern peninsula of Michigan. Mr. Constable was chief mechanical and electrical engineer for the Republic Iron & Steel Company, of Duluth, for the past five years, and previously was connected with the General Electric Company in the mining, locomotive and steam-turbine department at Duluth.

G. C. Kahl, 404 Dwight Building, Kansas City, Mo., has been appointed sales representative of the De Laval Steam Turbine Company, in Arkansas, Nebraska, Kansas and Oklahoma, Iowa west of the north and south line through Des Moines but not including Des Moines, and Missouri west of and including Jefferson City. Mr. Kahl was formerly connected with the Thermal Efficiency Company, representing the De Laval Company in Kansas City, and prior to that was sales engineer for the General Electric Company in Kansas City. Mr. Kahl has had a broad experience in steam turbines, centrifugal pumps and blowers, etc.

General Electric Distributes Bonus to Employees

More than a million dollars in supplementary compensation was paid August 4 by the General Electric Company to those of its employees who have been with the company continually for five years or more. The bonus payments are for the six months ended June 30 last and amount to 5 per cent of the earnings of the employees during that period. A total of 27,412 employees shared in this distribution, which was paid largely in bonds of the General Electric Employees' Securities Corporation. The total amount paid was approximately $1,172,000.

Fairbanks-Morse to Construct Branch Factory at Los Angeles

The Fairbanks-Morse Company, Chicago, has plans under way for the construction of a branch factory at Los Angeles, estimated to cost $1,000,000, including machinery and equipment. It will be used to supply the Pacific Coast trade as well as the Oriental export business. Colonel Robert Morse, an executive of the company, will be at the Hotel Ambassador, Los Angeles, for a few weeks completing negotiations for the construction of the new plant.

The Splitdorf Electrical Company announces that E. A. Kelley, for many years associated with it, has been advanced to the position of director of branches and will have charge of all Splitdorf branch and distributor sales and service, with headquarters at the factory, Newark, N. J. Mr. Kelley has been successively on the Pacific Coast, in Chicago and as factory representative in Detroit for the company. Mr. Kelley brings to his newer and larger responsibilities great experience and executive ability.

The Gibb Instrument Company, manufacturer of electric welding equipment, Bay City, Mich., announces the appointment of D. A. Clements to represent the company in Missouri and southern Illinois with headquarters at 4167 Washington Street, St. Louis.

The Palmyra Electric Company has been formed at Palmyra, N. J., by Melvin R. Blackwell, Alvin C. Hurley and associates to take over and continue the operation of the industrial electrical contracting business of Mr. Blackwell. The address is 311 Broad Street.

The Locke Insulator Corporation, Baltimore, has awarded a contract to J. Henry Miller, Inc., of that city for the construction of a one-story addition to its insulator plant.

The Callworth-Radio Company has been organized and incorporated by W. G. Farnsworth and associates, Grand Rapids, Mich., with a capital of $30,000, to license manufacturers to produce the McCall compensated circuit.

The Marathon Battery Company, since organized in April of this year to manufacture and sell flashlight and radio batteries, ignition and telephone dry batteries, flashlight cases and other electrical equipment, has enjoyed such growth of business that the sales territory has spread to Ohio, Illinois, Missouri, Iowa, Minnesota and Michigan. Starting with a small figure, the capitalization of the company has been increased to the hundred-and-fifty-thousand-dollar mark and fifty people are now employed. The officers of the new company are W. H. Thom, president; E. H. McEachron, vice-president; L. H. Wheeler, secretary, and E. A. Fuller, treasurer.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., manufacturer of telephone instruments, radio equipment, etc., has awarded a contract to John B. Pike & Son for the construction of the first unit of a new plant on Humboldt Street, estimated to cost $200,000 with equipment. Work will proceed at an early date.

The William Cramp & Sons Ship & Engine Building Company, Philadelphia, and the **Pelton Water Wheel Company,** San Francisco and New York, announce the opening of a Southern office at the American Trust Building, Birmingham. Quin W. Stuart has been appointed district engineer.

The Repuolic Flow Meters Company, 2240 Diversey Parkway, Chicago, has published the first of a series of articles covering the various phases of boiler operation by G. F. Gebhardt, author of "Steam Power Plant Engineering." These articles have been written by Mr. Gebhardt for the Republic Flow Meters Company in the interest of greater power-plant efficiency and will be published monthly.

The General Electric Company has installed its "Novalux" highway units on nine additional miles of the main New York State highway between Albany and Schenectady. With the original two-mile installation eleven of the fifteen miles are now equipped with this system. The plan of the original installation has been followed, with the lamps mounted on poles of the power line, 300 ft. apart and 30 ft. high, using 250-cp. units.

The Ridgway Dynamo & Engine Company, Ridgway, Pa., has recently entered into a contract with the Sanitary District of Chicago for furnishing seven large, high-speed, motor-driven blowers for use in a new sewage treatment plant to be built at Niles Centre, Ill., a suburb just north of Chicago. These blowers are to deliver air at a normal pressure of 7.75 lb. per square inch, three of the blowers having a capacity of 30,000 cu.ft. each per minute, the other four being of 40,000 cu.ft. rating each. All of the blowers are to be driven by three-phase, 60-cycle, 6,600-volt, 3,600-r.p.m. self-starting synchronous motors.

The Worthington Pump & Machinery Corporation, 115 Broadway, New York, has placed a "repeat" contract with the Austin Company, engineer and builder, Cleveland, for the construction of a new unit at its Buffalo branch plant. The contract calls for a pattern-storage building 80 ft. x 200 ft. and two stories high. Construction and all purchasing will be handled through the Cleveland office of the Austin Company.

The Esterline-Angus Company, Indianapolis, Ind., manufacturer of electrical instruments, announces that G. P. Atkinson has been appointed sales representative for the State of Georgia, with headquarters in the Atlanta Trust Building, Atlanta.

The Hart Manufacturing Company, Hartford, Conn., manufacturer of switches, receptacles, etc., has appointed Grosvenor C. Barry, formerly manager of the New York City branch office of the company, as sales manager with headquarters at Hartford.

The Delta-Star Company, 2400 Fulton Street, Chicago, has just started the publication of a monthly message of "common and uncommon sense," as H. W. Young, the president, labels it, called *The Delta-Star*. The publication is the personal production of the president, and the first issue is devoted particularly to his observations and reflections during a recent trip to Europe.

The Economy Fuse & Manufacturing Company, Chicago, has changed its district headquarters for the Rocky Mountain region from Seattle to Denver with F. L. Easton in charge. Mr. Easton on a recent visit to Salt Lake City and surrounding territory engaged the services of W. T. Lawrence to represent the company in that territory.

The Okonite Company, Passaic, N. J., has appointed J. L. Phillips manager of the San Francisco office. Mr. Phillips was formerly manager of the Atlanta (Ga.) office, where he has been succeeded by George N. Brown.

The Electric Power Equipment Company, Philadelphia, announces the appointment of E. A. Thornwell as its agent in Atlanta, Ga., and the opening of a new agency in Kansas City, Mo., in charge of C. M. Fergusson.

The R. V. Pettingell Electric Supply Company, 51 High Street, Boston, has been appointed New England distributor of the electrical appliances made by the Fitzgerald Manufacturing Company, Torrington, Conn.

The Sundh Electric Company, Inc., Newark, N. J., has appointed the Wallene Engineering Company, comprised of Frank O. Wallene and Glen E. Guy, 511 Hippodrome Building, Cleveland, Ohio, as its representative in northern Ohio to succeed P. J. Burrill, who has resigned. Dave O. Stewart, formerly with the Cutler-Hammer Manufacturing Company, has also been appointed by the Sundh company as representative at St. Louis, with offices at 619 Bank of Commerce Building, to succeed Thomas E. Beasley, who has been transferred to the Chicago office where he has been placed in charge.

The B. F. Sturtevant Company, Hyde Park, Boston, has appointed E. Jones, formerly of the Chicago sales office, as district sales manager of the Missouri, Kansas and Nebraska territory, with headquarters at 722 Dwight Building, Kansas City.

The W. N. Albertson & Company, Inc., Milwaukee, Wis., announces the removal of its factory at 27 Erie Street to larger quarters at 1278 South Pierce Street. The new factory will occupy approximately 15,000 sq.ft. and will be used exclusively for the rebuilding and repairing of transformers, meters and power plant equipment. The general offices of the company are to remain in the First Wisconsin National Bank Building, Milwaukee.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., announces that the Buffalo office, located in The Ellicott Square Building and formerly a part of the Eastern district, has been made a part of the central district, of which A. G. Pierce is general district manager, with headquarters at Pittsburgh. The central district includes the territories covered by the Buffalo, Pittsburgh, Cleveland and Cincinnati offices. B. A. Hansen is manager of the Buffalo office.

The Inter-State Machine Products Company, Inc., Rochester, N. Y., announces that its "type F" Sterling Siren has been improved by the installation of a larger motor and it has also been redesigned to give a more pleasing and substantial appearance.

The Commercial Truck Company, Philadelphia, announces that Horace S. Meese, who has had charge of the export and transportation engineering departments of the company for the past two years, has been made general sales manager and, under the company's new policy, will have charge of all three departments.

The G. C. Chewning Electric Company, 1022 Hull Street, South Richmond, Va., was recently reorganized and the firm name was changed to Chewning & Wilmer, Inc., electrical contractors and engineers. G. C. Chewning is president of the new company and T. W. Wilmer, formerly with the Western Electric Company at Richmond, is secretary and treasurer.

The Link-Belt Company, 910 S. Michigan Avenue, Chicago, has developed a new top for its regular compression grease cup. The top is hexagonal in shape and is also provided with a raised slot so that the cup can be turned with a screwdriver.

The Connecticut Electric Manufacturing Company, Bridgeport, Conn., manufacturer of electrical specialties, has placed on the market a Bakelite toggle switch plate known as "No. 7121" and a duplex unit receptacle known as "No. 990." Both of these units are made of brown Bakelite with an eggshell finish that does not tarnish or require refinishing.

The Detweiler-Bell Company, Inc., 152 Temple Street, New Haven, Conn., manufacturers' representative, announces that R. H. McCormick, formerly Boston representative of Harvey Hubbell, Inc., has taken over the interest of Stewart Bell. Mr. McCormick will have charge of the Boston office and will represent the company in eastern New England.

The Whiting Corporation, Harvey, Ill., builder of cranes, gate hoists and special machinery for water-power plants, has established a separate department to handle complete installations for head gates, sluice gates, etc. This department will be in charge of A. E. Johnson, formerly with the Dominion Bridge Company, who has had many years experience in the design and construction of such equipment.

The Triumph Electric Company, Cincinnati, Ohio, announces that E. C. Morse, vice-president in charge of sales, has resigned. R. W. Hobart has been placed in charge of motor sales and R. C. Hayes has been appointed sales manager for the Triumph Ice Machine Company division. The company also announces that the W. C. Fletcher Company, 1016 Fletcher Trust Building, Indianapolis, Ind., has been appointed representative to handle motor sales in the southern half of Indiana.

The Wagner Electric Corporation has appointed Herschell A. Hearn manager of its Indianapolis office. For two years previous to this Mr. Hearn had been in charge of the company's Dallas office.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Industrial Electric Furnace

A new industrial hearth-type electric furnace for operation up to 1,850 deg. F. has been placed on the market by the Westinghouse Electric & Manufacturing Company. These furnaces, which are known as "type B," are made with hearth sizes ranging from 4 in. wide and 10¼ in. deep to 12 in. wide and 36 in. deep and are particularly well suited for such operations as annealing, hardening, tempering, laboratory work, etc.

The furnace is provided with automatic temperature control and the muffle plates, which completely inclose the heating chamber, are perforated so that heat is radiated directly from the heating element to the charge. The elements consist of S-bend coils of nickel-chromium wire, are placed on all four sides of the heating chamber and are supported and aligned by molded studs on the muffle plates. The insulation is so arranged that the muffle plates do not carry any weight. The door of the type B furnace is suspended by a chain from one point, and pieces of angle iron bolted to the guides are so adjusted that the door is held closely against the front casing when closed, but can move easily when being opened. The furnace shell, or casing, is of heavy sheet steel, with the sides and bottom in one piece. The top, however, is a separate piece, to facilitate removal for the purpose of making repairs to the insulation or heating element. The rear casing design is a frame supporting an asbestos panel, through which the ends of the heating coil protrude. Heavy air-cooled connectors join the coils in series and connect to the lines.

Undergrate Blower

A new high-efficiency turbo-undergrate blower has just been added to the general line of exhausters and blowers manufactured by the Buffalo Forge Company, Buffalo, N. Y. The new unit has a six-blade propeller wheel made of aluminum composition and is provided with a cast-iron housing. The propeller wheel is 16 in. in diameter and may be operated at any speed up to 4,000-r.p.m., at which speed it will deliver 6,000 cu.ft. of air per minute. The high-efficiency characteristics of the unit is said to be due principally to the design of the blades, the pitch being greater near the hub or center, where the peripheral speed is lowest, and is gradually reduced to the tip, where the speed is highest. This more nearly equalizes the pressure conditions and eliminates backward flow near the center of the rotor.

The turbine designed especially for use with this blower has its wheel blades made of monel metal, while the ball bearings are two sizes larger than actually required for the service. The unit may be used in connection with a pressure regulating valve so that the volume of air delivered in the ash pit will vary inversely as the steam pressure.

Electric Drum Hoist

A new 6½-hp., small, compact, powerful, electric, portable, single-drum hoist has been developed by the Sullivan Machinery Company, 122 South Michigan Avenue, Chicago. The hoist weighs only 480 lb. and has a capacity of 2,000 lb. dead load lifted vertically at 110 ft. per minute. It can be mounted on a cross-bar or column in a shaft, or it can be bolted to a timber or girder or a tree, or to a wall or floor.

A totally inclosed 230-volt direct-current Westinghouse motor is used, supported in one end of the frame or base of the hoist, and supplies power through ball-bearing and roller-bearing speed-reduction gears to the hoisting drum, which holds 500 ft. of ⅝ in. wire rope. The hoist may also be had in the double-drum type for dragline scraper work. The starting box furnished with each hoist is moisture-proof and is so constructed that it can easily be hung on a spike.

Evaporator

An evaporator designed for the production of pure distilled water for boiler feed makeup, known as the "G-R Bentube Evaporator," has been placed on the market by the Griscom-Russell Company, 90 West Street, New York. This method of water purification eliminates all scale-forming material from the water before it enters the boiler.

The evaporator consists of a shell and vapor dome of welded steel plates, with tube headers of cast iron, into which are expanded seamless drawn "Admiralty" tubes which are bowed. The steam enters the tubes and evaporates the raw water in the shell. These bowed tubes distort with temperature changes effectively cracking off accumulated scale. The tube bundle consists of a series of independent vertical sections, each easily removable for inspection.

Porcelain-Enameled Reflectors

Porcelain-enameled steel-dome reflectors with diffusing glass bowls supported underneath, known as the "glass-steel ABolite," are being marketed by the National Screw & Manufacturing Company, 2440 East Seventy-fifth Street, Cleveland. Knurled screws passing through the neck of the reflector and gripping a metal ring slipped over the lip of the glass bowl hold the latter in place. The reflectors have a white enamel finish inside and out. Intense ceiling shadows are eliminated by allowing a small percentage of light to pass through several openings in the top of the reflector. The units are made in two designs—the one-piece reflector with formed neck, known as type GSF, and a threaded-neck reflector for a screw-type holder socket, known as type GST. Both are 18 in. in diameter and are provided with medium-base sockets for lamps of 200 watts and under. Both types are threaded for use with ½-in. conduit.

New Trade Literature

STORE LIGHTING.—The Curtis Lighting, Inc., 1119 West Jackson Boulevard, Chicago, has issued a booklet (No. 393), in which it illustrates the use of "X-ray" reflectors for use in show windows, display cases, and for interior of stores.

REMOTE CONTROL SWITCHES. — "A Manual of Remote Control Equipment" is the title of a 64-page catalog issued by the Hart Manufacturing Company, Hartford, Conn., which is devoted exclusively to the "Diamond H" remote control switches.

ELECTRIC HEATERS FOR CURLING IRONS.—The Op-Al Electric & Manufacturing Company, 1057 West Thirtieth Street, Indianapolis, Ind., is distributing a circular covering the "OP-AL" electric heaters for curling irons.

SYNCHRONOUS MOTOR DRIVES.—The Electric Machinery Manufacturing Company of Minneapolis has recently issued a 16-page bulletin, No. 885, based on a paper presented at the London conference in June by Truman Hibbard. This bulletin deals with synchronous motor drives in ice and refrigerating plants. A table includes comparative data on medium and low-speed synchronous motors.

AUTOMATIC RANGE.—Catalog supplement 3095 B, leaflet A 425, has been issued by the Edison Electric Appliance Company, Inc., 5600 W. Taylor Street, Chicago, announcing the new Hotpoint automatic range RA101. Accompanying the leaflet are dealers net prices (Form 641-35D) and suggested retail prices (Form 305-35) covering ranges and water heaters.

TRANSFORMERS.—The Pittsburgh Transformer Company, Pittsburgh, Pa., is distributing bulletins Nos. 2,032 and 2,033, covering the mechanical and electrical design of "Pittsburgh" transformers and the "Pittsburgh" distributing transformers, single phase and polyphase, respectively.

CREOSOTED YELLOW PINE POLES.—A well-illustrated booklet covering "International" pressure-creosoted Southern yellow pine poles has been issued by the International Creosoting & Construction Company, Galveston, Tex. The booklet contains detailed interesting data and specifications on creosoted poles and "International" methods of pole production, treatment and distribution. There is a complete and good treatise on the economies of pole treatment using creosote and on methods of treating poles by the full-cell and empty-cell processes of impregnation. Tabulated data are given on the physical properties of poles, and standard specifications on pole treatments are included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Johannesburg, South Africa (No. 11,247), for radio equipment.

An agency is desired in Palermo, Italy (No. 11,246), for telegraph and radio supplies.

Purchase is desired in Goteburg, Sweden (No. 11,249), of varnishes for railway coach bodies, automobiles and for electrical insulation.

An agency is desired in Copenhagen, Denmark (No. 11,217), for brass and copper wire.

TENDERS ASKED FOR INSULATORS FOR THE MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until Oct. 20, for 22,000-volt insulators for the Morwell power scheme, as per specification 24/68. For details see Searchlight Section.

PROPOSED TELEPHONE SYSTEM IN VENEZUELA. — Permission has been granted to one of the States in Venezuela, according to *Commerce Reports*, to construct a telephone line about 340 km. long, to connect important cities in near-by territory.

SPANISH POWER COMPANY CONTEMPLATES EXTENSIONS. — The Cooperative Electrica de Langreo, which furnishes electricity to the mines of the Langreo region, *Commerce Reports* states, is planning to extend its service to the mines of the Mieres and Oviedo districts and to furnish electric energy to the Austrian Railways.

HYDRO-ELECTRIC PLANT PROPOSED AT NARVAL FALLS, ESTHONIA.—British capitalists according to *Commerce Reports*, are seeking the right to develop the water power at Narval Falls. The cost of the proposed power plant is estimated at £1,500,000. The Esthonian Government has been asked to guarantee a market for the total amount of power that is available.

New Incorporations

THE CENTRAL POWER COMPANY, Albemarle, N. C., has been incorporated with a capital stock of $100,000 by Charles B. Hawley, J. E. S. Thorpe of Washington and R. L. Smith of Albemarle.

THE HUNTERSVILLE (N. C.) LIGHT & POWER COMPANY has been chartered with a capital stock of $20,000 by M. C. Hunter, S. T. Caldwell and R. C. Bedford.

THE HUBLY LIGHT & POWER COMPANY, Mason City, Ill., has been incorporated by George L. N. Behrens, Henry McCreery and John Amerkamp, all of Mason City. The company proposes to furnish electricity to and throughout Mason County.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LOWELL, MASS.—Negotiations are under way between the Board of Public Service and the Lowell Electric Light Corporation for remodeling the street-lighting system on the main thoroughfares in the city. The cost of the work is estimated at about $100,000 and will include replacing the arc lamps and incandescent lamps with "Type B" lamps of 1,000 cp. and extension of the ornamental lighting system to cover the entire downtown section of the city.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company, it is reported will soon take bids for the construction of the proposed extension to its electric generating plant on Eddy Street, to cost about $2,500,000. Jenks & Ballou, Industrial Trust Building, are engineers.

PUTNAM, CONN.—The H. K. H. Silk Company plans extensions to its power plant, including the installation of hydro-electric equipment, etc.

Middle Atlantic States

ARKPORT, N. Y.—The New York Central Electric Corporation has taken over the municipal substation used for distribution and will furnish service from its transmission lines in the future.

CANANDAIGUA, N. Y.—The installation of a new street-lighting system on Green and Tillotson Streets and West Avenue is under consideration by the City Council.

CHATHAM, N. Y.—Application has been made to the Public Service Commission by the Chatham Electric Light, Heat & Power Company for permission to erect transmission lines in the towns of Canaan, New Lebanon, Stephentown and adjacent territory, covering a distance of about 11 miles. The company is also considering an extension from Austerlitz to and through the hamlet of Red Rock, about 6 miles long.

ELMIRA, N. Y. — The Elmira Water, Light & Railroad Company has applied to the Public Service Commission for permission to erect transmission lines to supply electricity in the towns of Dix and Reading.

ITHACA, N. Y.—The New York State Gas & Electric Company has petitioned the Public Service Commission for permission to exercise electric franchises and begin construction on distribution systems in Interlaken, Moravia, Morris and Locke.

MIDDLETOWN, N. Y. — The Rockland Light & Power Company has received permission to acquire a controlling interest in the Orange County Public Service Company. Plans under way for the erection of transmission lines to connect the systems.

NEWARK VALLEY, N. Y.—The Binghamton Light, Heat & Power Company has taken over the municipal electric plant and will close down the station. Extensions will be made in transmission lines for local service.

NEW YORK, N. Y.—The American Sugar Refining Company, 117 Wall Street, is reported to be planning to build a power house at its proposed refining plant in the harbor district to replace an existing plant at Brooklyn. The entire project will cost about $1,500,000.

NEW YORK, N. Y.—The Dollar Freight Terminal Company, 11 Moore Street, will install electric power equipment, including electric traveling cranes, conveying machinery, etc., at its proposed freight terminal at Hunts Point, to cost about $2,700,000. Stone & Webster, Inc., 120 Broadway, New York, is architect and engineer.

NIAGARA FALLS, N. Y.—The Niagara Falls Electric Service Corporation has applied to the Public Service Commission for permission to construct an electric distribution system in the town of Niagara, north of the Lockport Road, which at present is without electrical service.

PLATTSBURGH, N. Y.—The City Council has authorized a special election to be held to submit to the voters the proposal to install an ornamental lighting system.

PORTVILLE, N. Y.—The Olean (N. Y.) Electric Light & Power Company has been granted permission to extend its lines in the town of Portville.

SELKIRK, N. Y.—The New York Central Railroad Company is reported to be considering equipping its local railroad yard for electrical operation. The plans include an electric lighting system consisting of 150 steel towers, 150 ft. high, equipped with daylight lamps.

SHERMAN, N. Y.—The Western New York Electric Company has taken over the municipal electric station and will extend its transmission lines to furnish service here.

TONAWANDA, N. Y.—The Tonawanda Power Company plans to install new transformers at its local substation.

KEANSBURG, N. J.—Bids will be received by the Borough Council until Aug. 19, for improvements to waterworks, including pumping station, equipment, including four motor-driven pumps, one 100-kva. generator directly connected to gasoline engine, filter equipment, etc. Alexander Potter, 50 Church Street, New York City, is consulting engineer.

NEWARK, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 28 for lighting changes in the United State post office and custom house in Newark, N. J. For details see Searchlight Section.

CORRY, PA. — The Corry-Jamestown Manufacturing Company plans to construct a power house in connection with general factory extensions. Oliver R. Johnson, Jamestown, N. Y., is architect.

HONESDALE, PA.—The installation of an ornamental lighting system from Fourth Street to Park Lake Bridge is under consideration.

JOHNSTOWN, PA.—The Bethlehem Steel Company contemplates building a power plant, to cost about $200,000. A. T. Kellar is engineer.

ST. MARY'S, PA.—Plans are under way by the Keystone Power Corporation for the erection of a 22,000-volt transmission line from Ridgway to St. Mary's, including a substation.

UNIONTOWN, PA.—The installation of an ornamental lighting system on Main, Fayette and Morgantown Streets and Gallatin Avenue has been approved by the City Council. The lamps will be installed by the West Penn Power Company.

HAGERSTOWN, MD. — The Tidewater Steel Corporation, 149 Broadway, New York, is said to be planning the construction of a power house at its proposed local steel works. The cost of the project is estimated at $85,000.

MANHATTAN BEACH, MD.—The Annapolis & Chesapeake Bay Power Company, Baltimore, has acquired the local electric distributing system and plans extensions. Manhattan Beach has not a post office.

BRISTOL, VA.—At an election to be held Aug. 19 the proposal to ratify a contract with the Edmundson Power & Electric Company to supply electricity for

power and light in the city will be submitted to the voters. The company plans to build a hydro-electric plant at Avon's Ford on the south Fork of the Holston River, about 14 miles from Bristol, and erect transmission lines to the city, and also to build a distribution station in Bristol.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Aug. 26, for four motor-generator sets and spare parts for the vessels *Lexington* and *Saratoga* (Schedule 2538).

North Central States

MONROE, MICH.—Plans are under way by the Detroit Edison Company for the erection of a steel-tower transmission line from Brownstown to Monroe. The new line will carry 120,000 volts and will supply additional energy for Monroe and immediate territory.

SAULT STE. MARIE, MICH. — The Dam Creek Lumber Company, Detroit, contemplates the construction of a power house at its proposed local mill.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Aug. 22 for insulating material for the Division of Water. Bids will also be received at the same time and place for coal-bunker larry equipment for the Division of Light and Power.

LIMA, OHIO.—The Air Reduction Sales Company, 342 Madison Avenue, New York, plans to build a power house at its proposed local branch plant. The cost is estimated at $100,000.

MINSTER, OHIO.—Bonds to the amount of $30,000 have been voted for extensions and improvements to the municipal electric light plant.

HICKMAN, KY.—A movement has been started by the Chamber of Commerce for the installation of an ornamental lighting system in the business section of the city.

FORT WAYNE, IND. — The board of directors of the Fort Wayne Lutheran Hospital has awarded a general building contract for a power plant at the institution. Henry W. Meyer, 615 West Jefferson Street, is architect.

ROCKFORD, ILL.—Plans for the proposed new plant to be erected by the J. L. Clark Manufacturing Company at Sixth Street and Twenty-third Avenue, to cost about $126,000, include a power house.

HURLEY, WIS. — The Hurley Water Service Company is considering the installation of electrically operated pumps in connection with its proposed new waterworks plant.

MILWAUKEE, WIS.—The installation of two additional pumping units at the Riverside pumping station of the municipal water system, to be either electrically or steam operated, is under consideration by the City Council.

BAUDETTE, MINN. — The Council is considering plans for the installation of a new lighting system on a number of streets.

BLAKELY, MINN. — The Waconia (Minn.) Light & Power Company plans to erect a transmission line between Waconia and Blakely to supply electricity for local service.

GLENCOE, MINN. — The Northern States Power Company is said to be planning to rebuild its local electric station, recently damaged by fire.

HIBBING, MINN.—The Council is planning to install an ornamental lighting system on a number of streets in the Brooklyn suburban district.

LAKE CRYSTAL, MINN. — Plans are under way for the installation of an ornamental lighting system, to cost about $25,000.

LITTLE FALLS, MINN.—The Federal Power Commission has granted the Pike Rapids Power Company a preliminary permit for a power project in Stearns, Benton and Morrison Counties, to be erected near Little Falls.

WASECA, MINN.—The Council is planning to rebuild the municipal electric plant, recently damaged. Additional equipment will be installed.

GREENFIELD, IOWA.—The Council has plans under way for an addition to the municipal power plant. O. H. Carpenter, Iowa City, is architect.

IOWA CITY, IOWA.—The Iowa City Light & Power Company contemplates the erection of a new high-tension transmission line from its power plant at Coralville to Iowa City, and also building a new substation at Coralville and at Iowa City. It is aso proposed to raise the voltage of the lines at Coralville.

SCARVILLE, IOWA.—Plans are under way for the installation of a municipal light and power system for which bonds have been issued.

NEWARK, MO.—The installation of a municipal light and power system is under consideration, for which bonds have been authorized.

REPUBLIC, MO.—The question of abandoning the local electric generating plant and erecting a new transmission line from the east terminus of the system of the Lawrence County Water, Light & Cold Storage Company, Aurora, at Billings, will be submitted to the voters at an election to be held Aug. 14. It is also proposed to rebuild the local distribution system. W. S. Merkle, St. Louis, is engineer.

ST. JOSEPH, MO.—The report of Arthur L. Mullergren, consulting engineer, Kansas City, for improvements to the municipal electric light plant and street-lighting system has been submitted to the city officials. The work will consist of the installation of a Diesel oil-engine unit, changing the existing direct-current street-lighting system to a series alternating-current system, converting 750 magnetite arc-lighting units to incandescent units, installing a new ornamental lighting system in the business district, and possibly adding 500 additional lighting units in the residence section.

GRAND FORKS, N. D.—A report and estimate of cost for a municipal electric light plant and distribution system to serve the entire city has been submitted to the City Commissioners by Arthur L. Mullergren, consulting engineer, Kansas City, Mo. The cost of the proposed system is estimated at $610,000. Bonds to the amount of $110,000 have been voted for the initial development for water pumping and for street lighting only. The City Commissioners are considering whether to proceed with the installation of the new plant or making a new agreement with the Northern States Power Company for purchasing current for municipal requirements.

COTESFIELD, NEB.—Preliminary plans under way to establish a municipal electric light and power system, to cost about $11,000. The Hollister Engineering Company, Bankers' Life Building, Lincoln, is consulting engineer.

KEARNEY, NEB.—The Council is considering the erection of a transmission line to the Riverdale section for light and power service.

LITCHFIELD, NEB. — Bonds to the amount of $20,000 have been voted for the erection of a transmission line to supply electricity for municipal service.

OMAHA, NEB.—Extensions and improvements are contemplated by the Nebraska Power Company, including the installation of a 20,000-kw. General Electric turbo-generator and a 1,800-hp. Babcock & Wilcox Boiler with auxiliary equipment in its plant, to cost about $200,000; the erection of a large substation, to be located near the heart of the city, to cost $200,000 complete, and construction of other substations and distribution lines, to cost about $600,000.

SCHUYLER, NEB.—Bids, it is reported, will soon be asked for additional equipment for the municipal power plant, including oil engine, etc.

Southern States

ATLANTA, GA.—The Southern Railway Company, Washington, D. C., contemplates the construction of a power house at its proposed local locomotive repair shops in this section, to cost about $700,000. The Foundation Company, 120 Liberty Street, New York, will act as engineer and contractor for the work.

PALATKA, FLA. — The Boaz Barrel Company, recently organized, plans to build a power house at its proposed local cooperage plant, to cost about $75,000.

SEBRING, FLA.—Bonds to the amount of $135,000 have been voted for improvements to the municipal light and water systems.

SEFFNER, FLA.—The Plant City (Fla.) Brick Company is reported to be planning to construct a power house at its proposed local plant. Ritter & Setzer operate the company.

TARPON SPRINGS, FLA. — The local electric light plant and ice factory, owned by the Southern Utilities Company, has been purchased by A. E. Fitkin & Company. The 60,000-volt transmission line of the Pinellas County Company, owned by the Fitkin company, is being extended from St. Petersburg to serve Tarpon Springs and will also be connected with the Florida Power Company, which operates a hydro-electric plant on the Withlacoochee River at Citronelle.

BESSEMER, ALA.—The Southern Manufacturing Company, Tuscaloosa, is said to be planning to build a power house at its proposed local mill.

DECATUR, ALA.—The Alabama Power Company will install a new lighting system in the business district, for which a contract has been received from the city.

MOBILE, ALA.—The installation of an ornamental lighting system on Atlantic Boulevard is under consideration by the County Commissioners. The plans call for 300 lamps of the "Novalux" type.

EL DORADO, ARK.—The City Council is considering the installation of a municipal electric light and power system.

LITTLE ROCK, ARK. — The Arkansas Central Power Company contemplates the construction of two automatic substations for both lighting and street-car feeders.

PINE BLUFF, ARK. — The Arkansas Light & Power Company contemplates the erection of a 66,000-volt transmission line from Pine Bluff to Camden.

COLUMBIA, LA.—The Columbia Light & Power Company is planning to erect a transmission line to Grayson, a distance of 4½ miles. D. Price is engineer of power station.

WISTER, OKLA.—The Southwest Power Company, McAlester, has been granted a franchise and also a contract to supply electricity in Wister. The company will erect a high-tension line from Wilburton to supply the service. Later the new line will be extended into Arkansas, where it will connect with the lines of the company there, formerly operated under the name of the Coal District Power Company.

AUSTIN, TEX.—Plans are under consideration by the State Board of Control for the installation of equipment for burning lignite fuel at the power houses at San Antonio and Terrell, including mechanical stokers, burners, etc.

HILLSBORO, TEX. — Preparations are being made by the Texas Power & Light Company for the erection of a substation in Hillsboro, to cost about $600,000. This station will receive power from the high-tension line (132,000 volts) from Hillsboro to Eastland, a distance of 127 miles.

Pacific and Mountain States

ABERDEEN, WASH.—The Grays Harbor Port Commission has authorized the purchase of a power unit to operate the Grays Harbor channel dredge.

RIVERSIDE, WASH.—Bids will be received by J. B. Williams, secretary Riverside Irrigation District, Riverside, until Aug. 25 for construction of a hydro-electric plant to develop 5,000 hp. on the Okanogan River, about 3 miles above Riverside. The work will include concrete dam, power house and about 15 miles of transmission lines. The equipment will include three vertical direct-connected units of 1,000 hp. each. The cost is estimated at about $250,000. The Miller Engineering Company, Burke Building, Seattle, is engineer.

SULTAN, WASH. — The Sultan River Power Company has applied to the State Supervisor of Hydraulics for water rights for a 5,000-hp. hydro-electric development on the Sultan River, near Index, to cost about $500,000. The undetaking will be known as the Lake Isabel power project.

TACOMA, WASH.—The City Council has authorized Commissioner Ira S. Davisson of the Light Department to purchase materials and proceed with the construction of the entire transmission line from the power house on the Skokomish River to the substation in Tacoma. The line will probably not be built until next year. Contract for copper wire has been awarded.

PORTLAND, ORE.—The Cascade Electric Company, it is reported, applied for permission to construct a hydro-electric power plant on the Salmon River, to cost about $500,000.

CULVER CITY, CAL.—Plans are being considered for the installation of an ornamental lighting system on Main Street.

LOS ANGELES, CAL.—The City Council has adopted the resolution formally placing on the ballot at the state-county primary election to be held Aug. 26 the $16,000,000 power bond issue for extensions and improvements to the municipal electric system.

LOS ANGELES, CAL.—The City Council will soon ask bids for the installation of

an ornamental lighting system on Hoover Street, Main Street and Broad Avenue.

MODESTO, CAL.—The Jennings School District is planning to erect a transmission line for light and power service.

PALO ALTO, CAL.—The City Council is considering plans for extensions to the municipal electric station, to cost about $60,000. The work will include the installation of underground conduits in the business section, to cost about $11,500. J. F. Byxbee is city engineer.

PASADENA, CAL.—The Municipal Light and Power Bureau has filed plans for the erection of a substation at 1415 North Raymond Avenue.

RED BLUFF, CAL.—Plans are under way for the construction of a power plant on Thomas Creek to develop 27,000 hp. The work will include 10 miles of conduit and building Bear Rock Dam. E. B. Perrin, care H. A. Kleugel, engineer, Balfour Building, San Francisco, is interested in the project.

SACRAMENTO, CAL.—Bids will be received by the Board of Supervisors until Aug. 30 for the construction of a power house and laundry for the County Hospital, to cost about $93,000. R. A. Herold is architect.

SACRAMENTO, CAL. — The Board of City Commissioners is having plans prepared for the construction of the proposed municipal hydro-electric plant on Silver Creek, including transmission system. The cost is estimated at $4,000,000. An appropriation of $64,500 for surveys is being considered. Albert Givan is city engineer.

SAN FRANCISCO, CAL.—A. P. Seybold and the Electro Metals Company, Hobart Building, have secured preliminary permits for the joint construction of a hydro-electric power project on the Klamath River in Humboldt and Siskiyou Counties, with transmission lines to Eureka, Trinidad and vicinity. The plans provide for a total development of 125,000 hp., to cost about $15,000,000.

SAN GABRIEL, CAL.—The Board of City Trustees is reported to be considering a new call for bids for the installation of ornamental lamps on Las Tunas Drive and a number of other streets, including a section of the Shore Road. Bids received on a previous call are higher than estimates.

SANTA ANA, CAL. — An investigating committee has been appointed by the Santa Ana Board of Realtors to look into the question of establishing a municipal electric plant in Santa Ana for furnishing electricity for street lighting and ascertain the cost of same.

GLOBE, ARIZ. — The Globe Light & Power Company has applied to the Arizona Corporation Commission for permission to extend its transmission lines to Claypool and Lower Miami to furnish electrical service in those towns.

PHOENIX, ARIZ.—The Salt River Valley Water Users' Association, Phoenix, which controls the Roosevelt Dam and the Salt River Irrigation & Power Project, is asking for bids until Aug. 28 for $4,743,000 in bonds, the proceeds to be used for development of additional hydro-electric power in connection with the United States Reclamation Service Salt River Project (Roosevelt Dam), now operated by the association.

Canada

MONCTON, N. B. — Investigations and borings are being made by H. M. Davey and George McLeod, engineers of the Department of Public Works, in connection with the proposed hydro-electric development of the Petitcodiac River.

CHESTER, N. S.—Plans, it is reported, under way for the installation of a hydro-electric plant and electric distribution system, to cost about $25,000. L. H. Wheaton, Halifax, is consulting engineer.

AUBURN, ONT. — The Hydro-Electric Power Commission of Ontario contemplates erecting a transmission line from Blythe to Auburn and installing a new electric lighting system in Auburn. The cost is estimated at about $35,000.

QUEBEC, QUE. — The Public Service Commission has granted permission for the extension of transmission lines as follows: To the Compagnie Electrique de Montmagny to extend its transmission lines from Montmagny to L'Islet and a few other villages; the United Power Company to erect transmission lines from Ste. Clotilde to Hemingford, and the Electric Service Corporation, Shawinigan Falls, to install transmission lines in the parish of Ste. Etienne des Gres.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 15, 1924)

1,501,074. MACHINE SWITCHING TELEPHONE EXCHANGE SYSTEM; R. L. Stokley, Floral Park, L. I., N. Y. App. filed April 20, 1921.

1,501,091. WATER ACTIVATED RESERVE CELL; R. C. Benner, Bayside, and H. H. Thompson, Flushing, N. Y. App. filed June 12, 1922.

1,501,103. CONJUGATE SIGNALING CIRCUITS; L. Espenschied, Hollis, N. Y. App. filed Sept. 26, 1919. Arrangements for associating transmitting and receiving circuits with a common transmission circuit to render the transmitting and receiving circuits conjugate.

1,501,104. MULTIPLEX RADIO SYSTEM; L. Espenschied, Hollis, N. Y. App. filed Sept. 26, 1919.

1,501,105. SUBMARINE SIGNALING; R. A. Fessenden, Brookline, Mass. App. filed March 23, 1918. The detection of submarines.

1,501,106. UNIVERSAL CONTACT BOX FOR WIRES; E. Gaillémin, Vincennes, France. App. filed March 21, 1921.

1,501,108. PROCESS OF CALCINING CARBON AND PRODUCTS THEREOF; V. C. Hamister, Cleveland, O. App. filed July 15, 1921.

1,501,109. SWITCHING SYSTEM; J. B. Harlow, Upper Montclair, N. J. App. filed June 24, 1919. For detecting the presence of submarine or other marine vessels.

1,501,115. PROTECTIVE ARRANGEMENT FOR ELECTRIC DISTRIBUTION AND TRANSMISSION SYSTEMS; P. V. Hunter, Purley, England. App. filed Jan. 20, 1921. Three-phase systems wherein four conductors are employed two of them forming the split conductors of one phase.

1,501,132. SIGNALING SYSTEM; P. B. Murphy, Nyack, N. Y. App. filed May 4, 1921. For telegraph using carrier waves.

1,501,157. ELECTRIC COUPLING FOR CARS; H. F. Woernley, Pittsburgh, Pa. App. filed July 5, 1919.

1,501,160. CONNECTER FOR ELECTRIC WIRES; G. M. Boren, Chicago, Ill. App. filed March 17, 1922. For connecting a service wire to the terminal posts in a fuse box.

1,501,174. SWITCHING SYSTEM; L. A. Mortimer, New York, N. Y. App. filed Sept. 24, 1920. Applicable to transmission lines composited for simultaneous telephony and telegraphy.

1,501,184. PROCESS OF MANUFACTURING ALLOY STEELS IN ELECTRIC FURNACES; N. Petinot, New York, N. Y. App. filed Nov. 16, 1922.

1,501,185. GAME; F. Portman, Vernon, B. C., Can. App. filed Sept. 5, 1922. Utilizing static electricity.

1,501,189. ELECTRICAL MEASURING INSTRUMENT; J. W. Record, Bowdon, England. App. filed June 26, 1922. Providing increased angular deflection substantially greater than the angular deflection of the moving element without the introduction of appreciable friction.

1,501,219. ELECTRIC ARC LAMP; H. Jackson, Higher Broughton, Manchester, England. App. filed June 16, 1921. For use in projecting lanterns.

1,501,235. TELEPHONE TRUNK CIRCUITS; A. J. Ray, Chicago, Ill. App. filed May 25, 1921. Adapted for use in automatic telephone systems.

1,501,236. TROLLEY POLE AND THE LIKE; P. Robbins, Dundee, Scotland. App. filed Dec. 17, 1923. To prevent fouling of the pole with the cross stays of the overhead wiring if it should leave the trolley wire.

1,501,239. PRESSURE OPERATING DEVICE; C. C. Runner, Schenectady, N. Y. App. filed Oct. 27, 1920. As used for operating motor controllers.

1,501,240. MANUFACTURE AND OPERATION OF VACUUM TUBES; K. Rottgardt, Dahlem, near Berlin, Germany. App. filed Aug. 26, 1921.

1,501,245. HEADLIGHT BULB; P. Sherman, Toledo, O. App. filed Sept. 26, 1921. Non-glare.

1,501,250. EXTENSION SWITCH BOX; F. A. Tefft, Toledo, O. App. filed July 18, 1921. That may be readily extended by the addition of duplicate parts.

1,501,263-1,501,264-1,501,265. SPEED REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 6, 1920. For maintaining the speed of rotating members susbtantially constant.

1,501,281. AUTOMATIC CALLING DEVICE; H. H. Ide, La Grange, Ill. App. filed April 9, 1920. As commonly used in telephone systems for controlling automatic switches.

1,501,284. SHORT CIRCUITER; E. P. Larsh, Dayton, O. App. filed Jan. 10, 1922. For repulsion induction motors.

1,501,287. AUTOMATIC TELEPHONE SYSTEM; C. E. Lomax, Chicago, Ill. App. filed April 19, 1920.

1,501,339. RHEOSTAT; S. R. Hipple, Williamsport, Pa. App. filed Dec. 5, 1922. With compressible resistance medium.

1,501,352. CONTAINING CELL FOR ELECTRIC BATTERIES; L. Lyndon, New York, N. Y. App. filed Dec. 23, 1919. Of wood, steel or other material and covered with a pyroxylin plastic.

1,501,372. MAGNETIC CIRCUIT OF ELECTRICAL MOTORS AND DYNAMOS; H. Robinson, Hoboken, Belgium. App. filed Aug. 17, 1921. Of superimposed sheet-iron stampings having pole tips and so arranged that coils can be passed over poles.

1,501,395. CURRENT REGULATOR; K. Crittenden, Highland Park, Mich. App. filed Jan. 16, 1922. For battery charging circuits.

1,501,402. VARIABLE CONDENSER; G. Jacobs, Detroit, Mich. App. filed Sept. 22, 1922.

1,501,410. STARTING MEANS FOR ELECTRIC MOTORS; L. W. Lund, Duluth, Minn. App. filed Sept. 14, 1922. For induction motor using a starting, winding and an automatically controlled starting switch.

1,501,413. PROCESS OF RECOVERING TIN; Alan Kissock, Los Angeles, Cal. App. filed June 15, 1921. From "tin scrap."

1,501,419. PROCESS OF PRODUCING BORON CARBIDE; E. Podszus, of Friedrichshagen, Germany. App. filed Jan. 4, 1921.

1,501,420. ELECTRODE FOR HIGH-TENSION ARC FURNACES; W. Siebert, Laufenburg, Argau, Switzerland. App. filed May 13, 1922.

1,501,437. ELECTRICAL SIGNALING APPARATUS; F. N. Connet, Providence, R. I. Transmitter member including a circuit-breaker device adapted to control the passage of current to a receiving instrument for the purpose of causing the receiver to indicate the extent of action of the transmitter.

1,501,466. TWO-POINT CONNECTOR LIGHT; PLUG; C. Porter, De Smet, S. Dak. App. filed June 17, 1922. Grounding plug for automobile lighting system.

1,501,472. PROCESS OF PRODUCING PARAMIDOPHENOL AND ITS COMPOUNDS; C. J. Thatcher, New York, N. Y. App. filed Jan. 24, 1920.

1,501,484 - 1,501,485 - 1,501,486 - 1,501,487-1,501,488-1,501,489. IGNITION SYSTEM; J. H. Hunt, Dayton, Ohio. App. filed Sept. 3, 1918. For internal combustion engines.

1,501,497. CONNECTING MECHANISM; E. H. Schwartz, Fort Lee, N. J. App. filed March 3, 1921. For connection of an electric motor with the flywheel gear of an internal-combustion engine for starting.

1,501,502. METHOD OF MANUFACTURING ACETALDEHYDE FROM ACETYLENE; E. G. Thorin, Mansbo, Avesta, Sweden. App. filed Dec. 3, 1920.

1,501,508. ELECTRICAL SYSTEM FOR AIRCRAFT; L. M. Woolson, Dayton, O. App. filed Nov. 14, 1917. Internal combustion engines.

1,501,518. IGNITION SYSTEM CONTROL; W. A. Chryst, Dayton, O. App. filed May 9, 1919. For internal-combustion engines.

1,501,519. ENGINE STARTING DEVICE; W. A. Chryst, Dayton, O. App. filed Jan. 28, 1920. For internal combustion engines.

1,501,520. STARTING AND GENERATING SYSTEM; W. A. Chryst, Dayton, O. App. filed March 22, 1920. For automotive vehicles.

1,501,521. IGNITION SYSTEM; W. A. Chryst, Dayton, O. App. filed Jan. 8, 1921. For internal combustion engines provided with a fuel burner.

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1,501,558. ELECTRIC MOTOR; J. H. Hunt, Dayton, O. App. filed Sept. 26, 1923. Controlling device including a plurality of field windings which can be separately operated.